ELECTRICAL ENGINEERING



JULY 1942

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Completely sealed, a bottle of champagne or an O-B bushing can acquire the grimy coating of a great many years and still be good. And the reason in both cases is the same--being sealed, nothing can enter which would change the contents. Several advantages result from sealing a bushing, all of which would be lost if temperature changes, mechanical strains or other influences could disturb the seal. In O-B bushings, permanent sealing is assured because all external porcelain-to-metal joints are held firmly in compression by a powerful coiled spring. With this assembly method, joints are self-tightening, gasket seals are never disturbed, and no dependence is placed on cement or bolts. The major purpose of sealing is to maintain the bushing's original electrical stability by preventing entrance of moisture-laden air which could reduce the insulating value of the oil. In addition to this function, sealing makes outdoor storage possible, allows handling in any position without losing oil, eliminates oil sampling, and permits immediate installation upon arrival. All these advantages are yours when you specify O-B bushings for your apparatus.



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JULY
1942

The Cover: The Stars and Stripes, symbol of our national unity, sails the Seven Seas as the United States Navy undertakes its huge task in the United Nations' battle for freedom. Electricity performs vital services in today's Navy. Official U. S. Navy photograph

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HIGH LIGHTS • •

Characteristics of Coaxial Lines. Data have been presented for the calculation of solid-dielectric coaxial line characteristics, particularly attenuation and surge impedance, from physical dimensions and known properties of the conducting and insulating materials. The ratio of terminal voltages as a function of the phase angle of the line has been shown for several types of load and for both dissipative and dissipationless lines; and a derivation indicated leading to a general equation for efficiency of transmission (*Transactions pages 526–30*).

Brush-Shifting A-C Motor. A method previously described for predicting the characteristics of the brush-shifting motor when the brushes are shifted to control speed has been extended to show use of the motor to correct power factor (*Transactions pages 502–06*). A final summary extends the analysis of the motor to include all possible phase positions of the voltage introduced into the stator coils from the commutator, controlling power factor and speed simultaneously (*Transactions pages 507–13*).

Rectifier Terminology. A set of terms and definitions has been assembled for the most important concepts relating to rectifiers, as an attempt to clarify the present confusion resulting from the lack of an exact terminology. "Reactance factor," one of the newly defined concepts, reduces rectifier-circuit constants to a single per-unit quantity, thus simplifying the analysis of rectifier circuits (*Transactions pages 496–9*).

Concentric Tubular Conductors. Concentric tubular circuits to carry heavy alternating currents, single-phase or three-phase, have been found to provide compactness, low reactance voltage drop, and reduced crowding of current to the surface of the conductors. Formulas for the reactance and skin effect of such arrangements of tubular conductors have been developed (*Transactions pages 513–18*).

Load-Center Unit Substations. Standard load-center unit substations have been developed to service load areas, such as buildings, mines, yards, docks, and camps, with low-voltage a-c power at utilization voltage. Tables have been provided for the selection of load-center unit substations to meet the requirements of the main types of low-voltage a-c distribution systems (*Transactions pages 519–25*).

June Supplement. The June 1942 "Supplement to *Electrical Engineering*—*Transactions* Section" will contain five technical papers and the discussions of these papers and those preprinted in the *Transactions* sections of *Electrical Engineering* from January to June 1942 inclusive; its appearance completes the publication of winter-convention papers and discussions (*page 360*).

Determining Efficiencies. Test results and analysis have indicated that the calorimetric method provides the most satisfactory over-all test of the performance of machinery under actual conditions of loading; a simplification of the classical technique has been introduced in which the important measurements are all electrical (*Transactions pages 530–2*).

Limiting Metal in Motors and Circuits. A method has been developed to determine the minimum cross section of copper and Nichrome that can be used on motors, motor control, and branch circuits to provide adequate current-carrying capacity during overload or short-circuit conditions (*Transactions pages 483–7*).

Design of Selenium Rectifiers. Characteristics of the principal sizes of selenium rectifier plates have been considered as applied to the design of single-phase, three-phase, full-wave, and half-wave rectifier units and all varieties of loading. Representative computations are included (*Transactions pages 488–95*).

Atom Accelerator. The tremendous potentialities inherent in the release of atomic energy lend additional interest to study of the mechanical and electrical problems that were solved in designing the largest of the various cyclotrons now being used or under construction to explore the atom (*pages 348–53*).

Airport Electrification. Special engineering problems were involved in adapting Civil Aeronautics Administration standards to a municipal airport of unusually large area and traffic volume, among them the development of specifications for many materials not previously manufactured (*pages 341–8*).

Fusing of Transformer Banks. Experience covering 15 years with high-voltage fusing of 11-, 22-, and some 66-kv transformer banks has shown that fuses, when applicable, are a satisfactory economical means of obtaining reasonable protection against faults in and beyond transformer banks (*Transactions pages 533–5*).

Directors' Report. The annual report of the AIEE board of directors for the year ending April 30, 1942, included in full in this issue, presents to the membership brief accounts of headquarters and committee activities and incorporates the annual financial tabulations (*pages 368–81*).

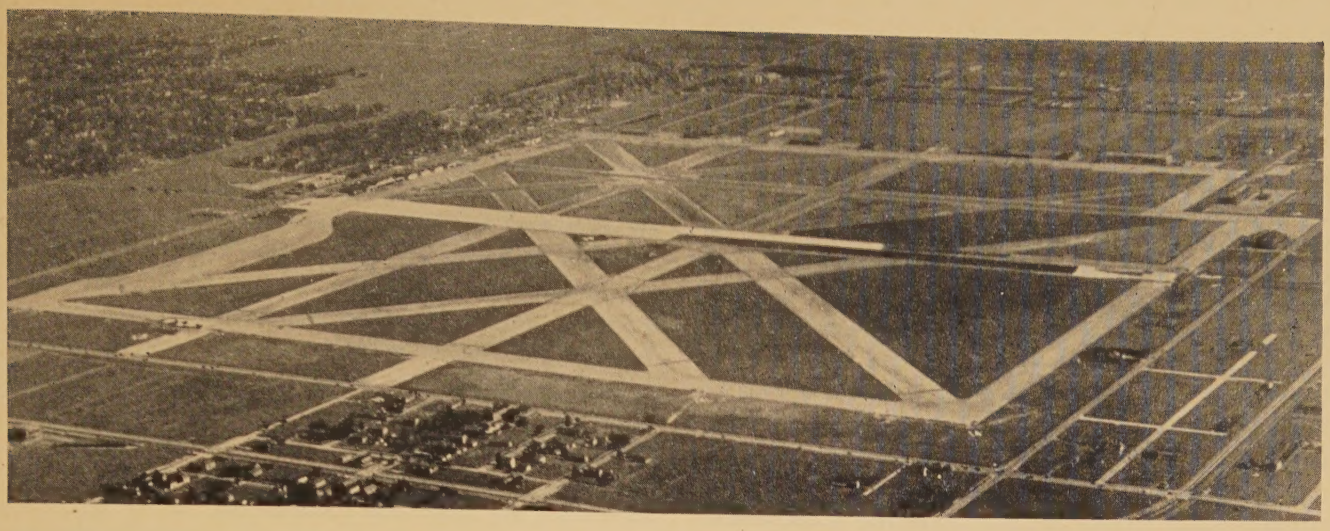
Temperature-Aging Tests. Data resulting from tests on class-A-insulated fractional-horsepower motor stators at 200, 160, and 135 degrees centigrade indicate that up to 200 degrees centigrade no abrupt change occurs in the temperature-aging curve (*Transactions pages 499–501*).

Limiter for Networks. A 600-volt totally enclosed limiter, developed for industrial distribution networks, will interrupt fault currents in excess of 50,000 amperes at 600 volts without perceptible noise or visible demonstration (*Transactions pages 536–8*).

Wind Shielding in Lines. Wind-tunnel tests on laboratory models of distribution lines show appreciable shielding of the leeward conductors by the windward conductors (*pages 354–7*).

Coming Soon. Among special articles and technical papers currently in preparation for early publication are: a group of articles reflecting the high lights of AIEE summer convention just concluded; a paper on sleet problems on electrified railroads by H. F. Brown (M'25); four papers relating to lightning and lightning protection—one on abnormal currents in distribution transformers resulting from lightning by J. M. Bryant (M'13) and M. Newman (A'39); one describing the effect of lightning on thin metal plates by K. B. McEachron (F'37) and J. H. Hagenguth (A'28); one on a practical counterpoise design to protect transmission lines from lightning by E. Hansson (M'35) and S. K. Waldorf (M'36); and one describing a modern cathode-ray oscillograph for testing lightning arresters by E. J. Wade (A'23), T. J. Carpenter (A'38), and D. D. MacCarthy (A'28); a paper describing a new moving magnet instrument for direct current by H. T. Faus (M'34) and J. R. Macintyre (A'41); a group of papers on ignitrons—one on sealed-tube ignitron rectifiers by M. M. Morack (M'42) and H. C. Steiner (A'32); one on ignitor excitation circuits and misfire indication circuits by A. H. Mittag (M'40) and A. Schmidt, Jr. (A'35); and one describing an analytical treatment for establishing load-center ratings of ignitrons by D. E. Marshall (M'33) and E. G. F. Arnott; two other papers on rating of apparatus, one on current ratings of electronic devices for intermittent service by R. E. Hellmund (F'13, deceased); and one on the application of apparatus and conductors under various ambient-temperature conditions by Doctor Hellmund and P. H. McAuley (A'36); a paper describing the carbon arc as an industrial tool by W. C. Kalb (F'40); a paper on the electronics of the fluorescent lamp by Mark A. Townsend (A'42); a paper on regulated rectifiers in telephone offices by D. E. Trucksess (M'40); a paper on emergency overloads for oil-insulated transformers by F. J. Vogel (M'41) and T. K. Sloat; and the third in a series of papers on the dielectric strength and life of impregnated-paper insulation by J. B. Whitehead (F'12).

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Electrification of the Chicago Airport

HARRY W. BAUMER
MEMBER AIEE

The electric system governing lights, signals, and controls for an airport with the area and traffic volume of the Municipal Airport at Chicago, Ill., presents problems not only in design, but in adapting to special conditions the standards specified by the Civil Aeronautics Administration for all United States airports. The results represent the latest practice, and include a number of unusual developments.

A YEAR ago it was my pleasure to visit the more important airports along the eastern seaboard of the United States from Boston to the District of Columbia. The one thing that each community has in common with all others, I found, is that each has the busiest airport or the largest in the world! With that experience to guide, let me deliberately avoid consideration of that particular phase in relation to Chicago's airport. The fact that Chicago continues to be the railroad center of the United States largely because of its geographical position suggests that it is also the crossroads of the nation's airlanes. Accordingly, the Chicago Municipal Airport may well become the most important landing field in this country.

For better comprehension of the many problems involved in the preparation of plans for the Chicago airport electrification project and the compilation of specifications for materials, many of which have not heretofore been manufactured previously, a description of the general location and layout of the field may be of interest. Chicago's Municipal Airport occupies an area of 620 acres—virtually one square mile from 55th Street to 63d Street and Cicero Avenue to Central Avenue, school-fund property under the jurisdiction of the Board of Education which is leased to the City of Chicago for airport purposes. The airport is situated 10.5 miles southwest of Chicago's business center, a 45-minute ride by automobile, accessible by four main traffic arteries and by two surface street car lines.

Initially only the 120 acres lying at the southeast corner of the present field were developed, by laying cinder runways and leasing small hangar lots to one or two pioneer airlines. The work was financed by small annual appropriations together with one bond issue of $450,000. With these sums the present administration building and terminal depot were built, and a concrete taxiway and four cinder runways laid. Before the development of Chicago's airport was undertaken in 1927, the ground plot on which the field is laid was a truck garden, low and swampy. This fact has necessitated laying more than 19 miles of sewer tile, constructing 550 sewer manholes and catch basins for proper drainage, and in addition providing almost 2,000,000 cubic yards of fill to raise the ground level to the present grade. From this beginning, with the aid of Federal Works Projects Administration funds, has grown the present airport.

In 1931 the administration building and passenger depot on the east side near the southeast corner of the original airport plot was built at a cost of $90,000 of the $450,000 bond issue. Because this building in the interval already has been outgrown completely, plans are now in preparation for the construction of a larger

Essential substance of an address delivered at the fall airport conference sponsored by the Illinois Institute of Technology, Chicago, Ill., October 30–31, 1941.

Harry W. Baumer, formerly engineer with the City of Chicago Electricity Bureau, in charge of the electrification of the Municipal Airport, is now on active duty as a lieutenant-commander in the United States Naval Reserve, stationed at the Navy Yard, Mare Island, Calif.

and more accessible terminal estimated to cost $2,000,000.

Chicago's airport is to date the only one in the United States having dual parallel runways. These lie in the direction of the cardinal and quadrantal points of the compass. They are spaced on 800- to 1,100-foot centers, and with the exception of the primary east-west runway, which is 300 feet in width, are 184 feet wide with an average length of 5,000 feet. They are paved with macadam. Since there are 9 runways in all, the field has 18 approaches from the air. The concrete-paved taxi strip that surrounds the field is 150 feet in width, except where it widens to 400 feet near the site of the proposed terminal buildings. The area of the paved runways and taxi strips is equivalent to a double-lane 20-foot highway 100 miles in length.

Eight major airlines are now operating in and out of Chicago, including American Airlines, Braniff Airways, Chicago and Southern Air Lines, Eastern Air Lines, Northwest Air Lines, Pennsylvania-Central Air Lines Transcontinental and Western Air Lines, and United Air Lines which has its administrative headquarters at Chicago. Pioneering in the adoption of safety measures, Chicago was the first airport at which a printed book of rules governed field operations, and it has established a record by not having had any major accident or injury to airliners or passengers on the field. The electrical facilities now under construction have for their objective the retention of this safety record.

There are periods of the day when airplanes land and take off not more than 30 seconds apart, because of the necessity of making connections at other cities. Thus the importance of the airplane controls being installed become readily apparent, especially in view of the increased traffic which must be anticipated in the years ahead. Simultaneous landings and take-offs are now common occurrences.

The electrical plan contemplates the installation not only of the customary nighttime and foul-weather aids to aerial traffic in the form of lighting, but also added signal facilities intended to provide unmistakable and effective control of airplanes, whether in the air or on the ground, equipped with radio or not, thus materially increasing the capacity of the port and minimizing the dangers associated with centralized aircraft operations.

The Civil Aeronautics Administration of the Department of Commerce has established certain fundamental, conventional electrical requirements, largely in the interest of uniformity and standardization. However, the problem of providing lighting and controlling electrical facilities at an air terminal as extensive as the Chicago airport requires not only compliance with basic CAA regulations, but the application of sound engineering judgment and recognized operating practice as well. Obviously the regulations and standards applying to airports throughout the United States are not suited in each detail to so large a terminal, and considerable latitude in the interpretation of the specifications becomes necessary. A fitting comparison may be drawn with small-town railroad way-stations and a large metropolitan railroad terminus—functionally the same, yet differing widely in scope and magnitude.

In planning the installation of the electrical facilities for Chicago's airport, the question of drainage has been important, especially in relation to that part of the installation affecting the paved portions of the field. Since substantially all pavements were in place before the electrical construction was planned, the selection of, locations for, and the methods of constructing the vaults, conduit lines, and lateral conduits have been the subject of careful and exacting study in order to reduce interference with air traffic during construction, and keep to a minimum the runway and taxi-strip openings with resultant costly pavement restorations.

Since obstructions above ground level are for obvious reasons not permissible either on the field approaches or within the limits of the landing area proper, which is that space outlined by the boundary lights, all electric cables and conductors necessary for the operation and the control of the various lighting and signaling circuits are installed in underground conduit lines. The routes established for these necessitated minimum interference with pavements, yet they are so positioned that all electric units being provided may be served conveniently and economically, remotely controlled, and maintained at minimum expense.

Approximately five miles of conduit have been built, containing from 4 to 12 ducts, which are encased in a three-inch envelope of concrete. The ducts are thin-wall asbestos cement three inches in internal diameter. The 58 vaults of reinforced concrete are spaced at intervals ranging between 400 and 500 feet in these conduit lines. Since switching equipment for remote control is being installed at runway ends, vaults at these locations are provided with sewer connections to the field drainage system. Other manholes and handholes are fitted with sumps.

Where individual circuits, such as those for boundary and runway contact lighting, pass under paved areas in all 97 locations, 2-inch heavy-walled fiber-duct laterals have been installed directly in the soil at a depth of 18 inches.

A three-phase four-conductor 4,000/2,300-volt electrical distribution cable encircling the field is being installed to serve not only the floodlights at the four field corners, but the ground and air signal lights and the illuminated runway numerals at the 18 runway ends as well. This cable feeds two ways from the airport substation and connects through transformers to the various individual load centers at points suited to distribution.

Cable sections adjacent to floodlight towers are terminated by means of disconnecting-type cable potheads electrically connected so that the cables normally form a continuous electrical circuit around the field. Should an electric fault develop in any section of this cable loop,

the faulty section can quickly be isolated. Cable requirements for this distribution circuit total 20,594 feet.

LIGHTING SYSTEM

Beacon lights at night guide aviators to their destinations and also mark the locations of fields whereon landings can be made. To outline these areas during periods of darkness and limited visibility, boundary lights are installed. These are spaced at approximate 300-foot intervals, the standard adopted by the CAA, so that pilots aloft not only can observe the field's shape but, on counting the spaces, readily can establish its proportions and extent.

The field outline at Chicago is marked by 54 white boundary lights fitted with 320-lumen 6.6 ampere series-burning lamps rated at 29 watts each. In addition to these white lights each runway extremity is marked by 4 green range lights. Two of these latter lie along the outer edges of the runway pavement and are connected in the boundary lighting circuit; the other two are positioned in the pavement in alignment with those along the edges, all being set on a line normal to the runway. The range lights are illuminated by lamps rated at 1,000 lumens, 6.6 amperes and 62.5 watts average. The position of these lights has been established upon a 20:1 glide angle, so that an airplane descending at that angle with range lights for guides in making ground contact will clear obstacles that exist outside the airport limits. Thus by directing their airplanes toward or beyond these green lights in approaching the field pilots are aided in making safe landings.

At night runways are indicated by parallel rows of lights along the pavement borders. These runway marker lights are placed opposite each other normal to runway axes on approximately 200-foot centers. These units, with the exception of their light-distribution characteristics and color filters, are identical in design and construction with the boundary lights and are illuminated by lamps of the same rating as those employed for the clear white boundary lights. Of the four green range lights marking the runway extremity, two are connected in the boundary-series lighting circuit; the other two are connected to operate only when the runway lights are in operation. Runway lights are designed to operate on asymmetric light distribution and are clear white except for those units set along the final 1,500 feet at the runway ends. These, through the use of a split color filter, produce a white light in one direction and a yellow light in the other. The yellow indication is intended to warn pilots that only a relatively short distance (1,500 feet) remains in which to bring the airplane to a stop. The boundary lighting circuit is operated continually from dusk to dawn and during other periods of comparative darkness, while the eight series runway circuits, fed by a multiple-conductor cable terminating in the control station, are controlled to operate individually as wind shifts require.

The number and width of runways at the Chicago airport and the radii of pavements at runway intersections introduce aspects of the problem of illuminating runways not met with in other installations, rendering standard luminaires unsuited and requiring design changes. The revised luminaire design is planned for economy in both installation and operation. Since series circuits are being employed for boundary and runway contact lights, where units are positioned within the paved areas but outside of the runway intersections proper, normally a lateral conduit would be provided for each unit, a separate lateral for the cable crossing under the pavement of the intersecting runway, and a third lateral for the unit at the far side of the runway pavement. Cable then would be installed to the first unit looping back, then brought through the lateral crossing the runway and another loop into the light at the other side of the pavement. This type of installation would involve not only added first cost for lateral and cable and increased copper losses during operation, but difficulty and expense in locating cables should cable faults develop. Through the use of slightly enlarged cable-entrance hubs on luminaires capable of accepting the two-inch diameter laterals and providing a continuous duct in the light housing it becomes feasible to install a single cable connection between units at runway intersections, by rodding the lateral straight through both lights onto the other side of the pavement. Hence no uncertainty need present itself as to where the cable connecting the unit at intersections lies, because the lateral is continuous from one pavement edge through the lights to be connected on the same circuit and beyond to the other pavement edge.

The luminaires employed for boundary and runway marker lights are flush-type, the housings being set down in concrete or in the runway pavements so that after the units are completely assembled the prismatic lens and cover do not project more than two inches above the grade. The lenses are designed and made of strong heat-resisting glass so that an airplane wheel striking one of them on landing or take-off will not readily cause damage either to the unit or the airplane. Suitable gaskets are provided to prevent the entrance of water into the light housings. The lower portions of these flush-type lighting units are sealed by means of compound similar to that used in making cable joints to exclude water from below. Each series-burning light, including the boundary and runway-marker light units, is fitted with the conventional film cutout used in street-lighting practice, so that when a lamp burns out, opening the circuit, the film breaks down, re-establishing the circuit until the lamp replacement has been made and a new film disk has been inserted.

The 428 runway or boundary lights are connected by 20 miles of single-conductor number 8 rubber-insulated and rubber-armored cable designed for 3,000 volts operating potential. This cable is laid 18 inches below the 3-foot wide white-top cement strips laid alongside each

runway edge as a marker, making the pavement limits more easily distinguishable from the air.

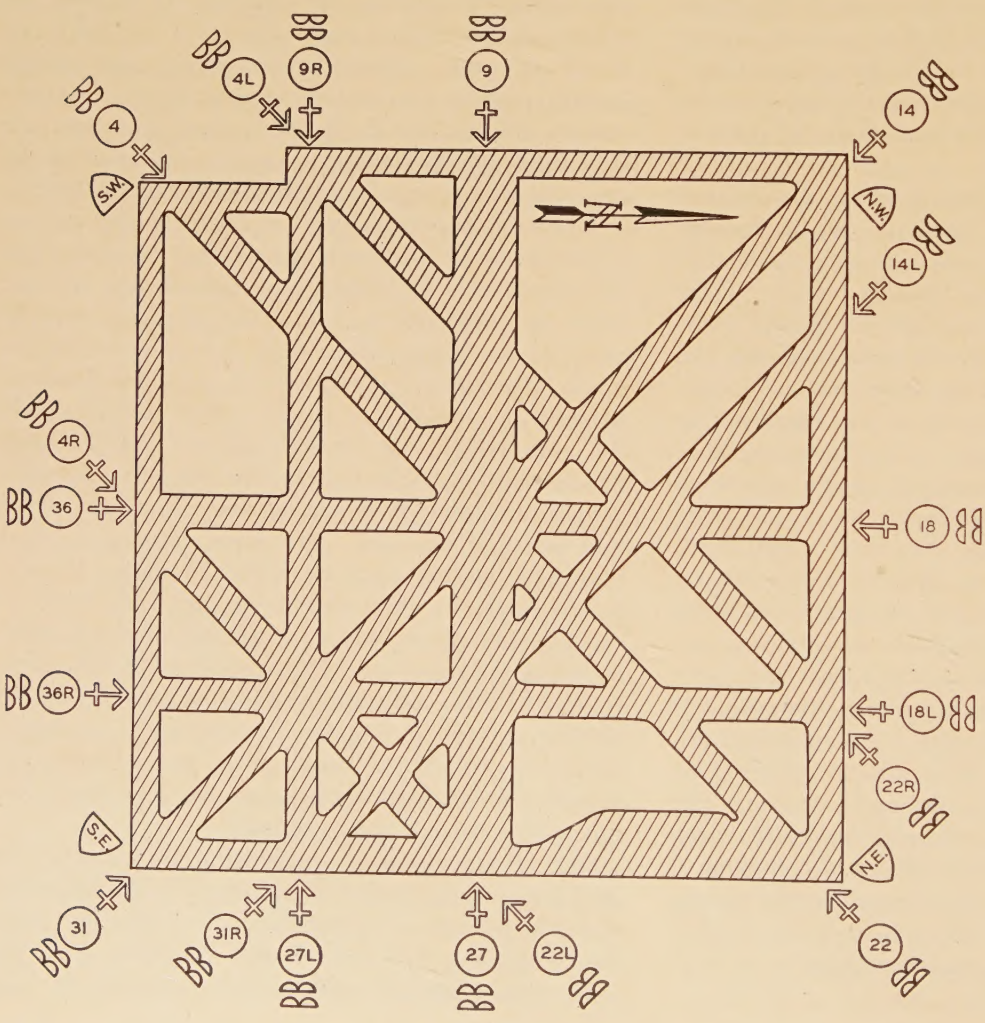
To supplement the lighting described, landing-area floodlights are being installed to produce illumination assisting pilots in judging altitude and distance, both so important in night landing. Four floodlight towers for mounting the floodlight banks are offset somewhat from the quadrantal runway axes, one at each corner of the field. Modernistic in architectural treatment, the towers are 22 feet high and 14.5 feet wide, the horizontal plan being in the shape of an equilateral pointed arch, the curved portions forming two sides, the faces being recessed for the entrance doorways and for mounting the floodlight lens frames. These structures are built of brick masonry finished with white cement plaster. The upper decks, 10 feet above grade, are for the installation of the optical systems of the floodlights, while the entrance steps at ground level are to house the electric equipment feeding and controlling the floodlights. The towers are marked as hazards by red obstruction lights operated through relays connected in the boundary lighting circuit.

Each bank of floodlights consists of 16 500-millimeter 90-degree Fresnel lenses, lighted by the same number of 1,500-watt 32-volt multiple incandescent lamps with monoplane filaments and Mogul bipost bases, which are capable of producing 42,000 lumens each and have a rated life of 100 hours. In addition to the lenses and lamps, metallic spherical mirror reflectors subtending angles of approximately 110 degrees complete the floodlight optical systems. Thus the connected lamp load at each of the four floodlight towers is 24 kilowatts. Each bank of floodlights is guaranteed to produce an illumination intensity of 0.3 foot-candle in the vertical plane at a distance of 3,000 feet. Thus each quadrant of the landing area is amply illuminated by the floodlight bank adjacent to it.

Double-hung hinged doors made of Transite enclose the floodlight lamp compartments within the building so that the exhaust fans for ventilating and cooling the lamp chambers can circulate the air which is admitted through screened louvers at the bases of these enclosures and discharged through others near the top. Remote-control oil switches operate the floodlights.

RUNWAY DESIGNATIONS

The Chicago airport was one of the first to employ the recently adopted revised system of runway designations. Under the new system, the runway ends are numbered by utilizing the reciprocals of their magnetic bearings. Thus if a runway lies east and west, the east end is numbered 27, representing the reciprocal of the magnetic bearing 270 degrees, which the pilot would follow in making a landing from east to west. If the runway lies north and south it is numbered "18" at the north end and "36" at the south end. The zero is dropped so that runway numbers consist of either one or two numbers.



Signal and light operation plan, Chicago Airport

(*See table on facing page*)

The adoption of this standard reduces air congestion at the airport since pilots upon receiving landing instructions by radio before they are in sight of the field are told what compass direction to follow in approaching the airport in order to land straight ahead. The advantage of this system is evident under conditions of reduced visibility, when numbers are not clearly visible from the air.

Numerals 50 feet in length, of reinforced concrete with white cement surfaces, are placed horizontally on the center lines of each runway end, slightly sloping from the field, being raised 1 foot above grade at the edge nearest the field and 6 inches at the edge farthest from the landing area. The vertical strokes of those numbers are 4 feet in width while the horizontal strokes are 8 feet wide so that they are clearly visible from an altitude of at least 500 feet in ordinary daylight. While ready identification of runways is important under daylight conditions it is vastly more so at night when additional landing hazards are introduced. Hence the numerals are illuminated by 1,600 lights placed on 2-foot centers on the upper faces of the numbers along the center lines of the strokes. The vaporproof fixtures utilized for these lighting units are anchored to the concrete and connected by means of iron-pipe conduit and fittings through which the connecting wires are brought.

SIGNAL SYSTEM

Since the rapidity with which airplanes are dispatched in arriving and departing is important and doubtless will become increasingly so during the next decade, a system of visual signals has been installed for control of airplanes whether they are in the air or on the ground, intended to supplement and to co-operate with radio control. At the end of each runway, behind the numerals just described and close to the fence lines, ground signals with one red, two green, and one clear white target in signal-enclosing heads are mounted seven feet from the ground on iron-pipe standards set on concrete bases and designed to give indications to airplanes on the runways.

To signal airplanes in the air a two-color (red and green) signal has been developed, which is visible only from the air during day or night. These signals are placed at the heads of horizontal white cement arrows pointing toward the runways. The arrows with shafts 90 feet long, 4 feet wide, and heads that measure 42 feet between barb-tip extremities, are laid on the runway center lines. The light signals mounted on them indicate by a green light that the runway is clear for landing and by a red light that it is closed for landing operation. The arrows are set outside the concrete taxi strips but ahead of the runway numbers.

The 120-volt feed for these lights is obtained from transformers installed in the floodlight towers and connected to the 2,300 volt primary distribution circuit. For controlling these signal lights and runway numerals, six multiple-relay switches in a submersible-type case are installed in the vault nearest the equipment to be operated at each of the 18 runway ends.

Multiple-conductor cables installed in the conduit lines are provided for the operation of these relay groups and the floodlight-control oil switches. Energy at 120 volts 60 cycle for relay and oil switch operation is supplied from a transformer connected to the bus in the airport substation and transmitted to the relays and switches over the multiple-conductor control cables, the

Signal and light operation plan, Chicago Municipal Airport

(See diagram on facing page)

Landings

Wind direction	N	N	NE	NE	NE	E	E	SE	SE	S	S	SW	SW	SW	W	W	NW	NW
Illuminated runway numeral—night only	36R	36	4R	4	4L	9R	9	14	14L	18	18L	22R	22	22L	27	27L	31R	31
Air traffic signal—green	36R	36	4R	4	4L	9R	9	14	14L	18	18L	22R	22	22L	27	27L	31R	31
Near end ground traffic signal—red	36R	36	4R	4	4L	9R	9	14	14L	18	18L	22R	22	22L	27	27L	31R	31
Runway lights night only	18L	18		4	4L	9R	9	14	14L	18	18L	22R	22		27	27L	31R	31
	36R	36		22	22R	27L	27	31	31R	36	36R	4L	4		9	9R	14L	14
Floodlights night only	SE	SE or SW	SE	SW	NW or SW	SW	NW or SW	NW	NW	NE or NW	NE	NE or NW	NE	SE	SE or NE	SE	SE or NE	SE

Take-Offs

Wind direction	N	N	NE	NE	NE	E	E	SE	SE	S	S	SW	SW	SW	W	W	NW	NW
Air traffic signal—red	36R	36	4R	4	4L	9R	9	14	14L	18	18L	22R	22	22L	27	27L	31R	31
Near end ground traffic signal—green	36R	36	4R	4	4L	9R	9	14	14L	18	18L	22R	22	22L	27	27L	31R	31
Far end take-off signal—green	18L	18	22L	22	22R	27L	27	31	31R	36	36R	4L	4	4R	9	9R	14L	14
Runway lights night only	18L	18		4	4L	9R	9	14	14L	18	18L	22R	22		27	27L	31R	31
	36R	36		22	22R	27L	27	31	31R	36	36R	4L	4		9	9R	14L	14

Emergency Stop*

Air traffic signal—red	36R	36	4R	4	4L	9R	9	14	14L	18	18L	22R	22	22L	27	27L	31R	31
Near end ground traffic signal—red	36R	36	4R	4	4L	9R	9	14	14L	18	18L	22R	22	22L	27	27L	31R	31
Far end ground traffic signal—red	18L	18	22L	22	22R	27L	27	31	31R	36	36R	4L	4	4R	9	9R	14L	14

* On emergency stop, runway and floodlights if operating continue in operation.

individual relay and switch circuits being completed through the common return wire.

POWER SUPPLY

The airport substation and control center is centrally located, in a position readily accessible for connection to the feed of the Commonwealth Edison Company, which furnishes electric service for the airport. The design of this structure represents a compromise between an underground vault and the conventional building at grade. Because of drainage problems the former was not deemed feasible; since the latter introduced air hazards it was not applicable. The building of monolithic concrete approximately 25 by 35 feet in plan with ceiling height 8 feet 6 inches extends 6 feet above ground level and $3\frac{1}{2}$ feet below grade. Windows provide ventilation and the advantage of daylight in the substation is gained. To guard against failure of service the company furnishes three separate 4,000/2,300-volt lines into this station, two of which originate at its own substations, while the third is brought into the city from a substation of the Public Service Company of Northern Illinois. If service interruption should occur on the normal supply it would be of merely momentary duration, because the three lines terminate at automatic oil switches electrically interconnected so that upon failure of the one feed another is automatically thrown on, and should this one be interrupted the third is then placed in operation. After the faults on the lines have been cleared, service automatically reverts to the normal feed.

Connected to this supply is the airport substation bus which is protected by a three-pole manually operated 15,000-volt 600-ampere oil circuit breaker having an interrupting capacity of 100,000 kva, fitted with overload protection and capable of being isolated from the supply through airbreak disconnect switches. Two 6.6-ampere constant current transformers, one to serve the boundary lighting circuit, the other the runway lights, are connected to this bus through fused primary cutouts and operated by remote-control oil switches. A general-service multiple transformer for station lighting and switch operation is also connected to the station bus. Both legs of the primary distribution circuit terminate at cable-end bells where the individual conductors are connected to fused disconnecting switches tied to the station bus. By this means the field supply circuit can quickly be isolated if trouble develops in it, while the boundary and runway lights continue in operation. After the fault has been cleared by disconnecting the faulty cable section or equipment causing the interruption, service can promptly be restored by again closing the fused disconnect switches.

The secondary of the constant current transformer energizing the runway lighting circuits is connected to an autotransformer and remote-control oil switches in such a manner that the runway light intensity can be adjusted to prevailing atmospheric conditions by operating the circuits at 6.1 amperes "dim" on exceptionally clear nights, at 6.6 amperes "normal" on average nights, and at 7.1 amperes "bright" when visibility is poor. The runway-lighting multiple-conductor feeder cable is connected to eight remote-control oil switches, one for each runway lighting circuit. A 24-cell lead storage battery for actuating the remote-control electric equipment is included in the station equipment.

Although the automatic control is considered very reliable, a manual control consisting of a single-pole double-throw switch for each circuit has been installed to permit the individual control circuits to be disconnected from the automatic system and operated manually from the substation if for any reason the automatic equipment fails to function.

CENTRALIZED CONTROL SYSTEM

In order that the various airport signals and other lighting facilities may be operated from the control tower and readily adjusted to the prevailing wind and weather conditions as frequently as may be necessary, and in the combinations for day and night take-offs and landings an unusual system of control is being installed. This method rather than the manual interlocking direct control commonly employed is being adopted to effect the necessary field signal operations during daylight hours, as well as both the signal and lighting arrangements for airplane movements at night and in periods of poor visibility, with minimum effort and reduced chances for error, through the elimination of the human element as far as possible. The present volume of traffic at the Chicago airport, the increase to be anticipated in the years to come, the number of air approaches to the field with its parallel and intersecting runways, and the many signal indications with their complex combinations deemed necessary to expedite field operations, warrant selection of equipment of proved reliable and sufficient flexibility to insure response under any circumstances likely to be encountered in service.

Switching apparatus similar to that employed on automatic telephone systems has been selected because of its dependability, compactness, and long life. The apparatus proposed consists of a control panel for installation in the central tower which is linked with a relay and selector switch rack in the substation by means of a 220-pair lead-covered cable. This equipment is actuated by the 48-volt lead storage battery installed in the substation battery room. Direct current is necessary for this service to insure prompt, positive impulse-switch and relay operation.

The operating switches mounted on the lower portion of the tower operating panel consist of 21 switchboard lever-type cam keys, 1 each for controlling the airport beacon, the wind tee, the boundary lighting circuit, the runway light brightness control, 3 groups of 4 keys each for field signal and light control and 5 keys for the operation of the 4 floodlights. Eighteen push keys

grouped in the lower left-hand corner, an impulse dial for runway selection in the lower right-hand corner, and a terminal block for the cables which connect the operating-indicator panel in the tower with the relay-switching equipment at the substation complete the panel assembly.

The remote-control relay rack, an angle-iron structure one foot by four feet by nine feet high erected in the substation, carries approximately 150 power-type relays, 35 fast-acting telephone-type relays, 6 25-point rotary switches, 2 11-point rotary switches which are interconnected, and fuse protection for the operating-control relay circuits.

The remote controls are the nerve center of the airport electric system, assuring the dispatcher that certain lights and signals in the field are in operation even though he may be unable to see them from his position in the tower. The manually operated equipment of the tower panel, being electrically connected with the automatic switching apparatus, actuates the remote-control relays and switches in the substation. After the establishment of the electrical connections that close the circuits to the switches energizing the field lights and signals that are being placed in operation, "telltale" indicator lamps behind the translucent portions of the tower control panel, corresponding to the signals and lights being illuminated, are lighted to indicate what light units are in operation.

Any description of the airport's electrical facilities and their functioning would be incomplete without an explanation of the co-ordinated operation of the lighting and signaling systems.

When an airplane arrives in the zone under the airport dispatcher's jurisdiction, the pilot announces his position by radio, referring to known landmarks and signifying his intention of landing. The dispatcher informs the pilot of the wind direction and velocity, and if the visibility is limited that information is also given. From the position of the anemoscope indicator on the control panel, the dispatcher observes runway numbers suited for landing or take-off.

If, for example, the wind is from the south, runways 18 and 18L are favorable and thus preferred. The pilot is instructed to land on runway 18. The dispatcher moves one of the left-hand cam keys of the three groups on the control panel to the lower "select" position and using the "runway selector" he dials number 18. The lever key then is returned to the mid- or "hold" position and immediately the number 18 at the right of the switch group being operated illuminates, indicating that signals and lights for landing or take-off on runway 18 can now be placed in operation by manipulating other switch keys of that group. If it is daytime the right-hand lever key of the group is set to the upper "day" position, permitting the operation of air and ground signal lights only. Up to this point no field units have been energized.

The airplane which has been announced is now near or over the field; the pilot reports his presence; and as he approaches for a landing the dispatcher operates the center key to the down "land" position. Immediately the illuminated runway numeral 18, the green air signal, and the red ground signal are placed in operation. The pilot observes the signal and number and makes the landing. Pilots of airplanes on the ground are warned by the red field signal to keep clear of the runway.

The same operating procedure applies for night landing, except that the right-hand key is set to the lower "night" position; then when the center key is turned to "land" in addition to the signals as for day landings, the contact lights along runway 18 are placed in operation, as well as the floodlight bank at the northeast corner of the field.

Most airplanes in use today can be landed and halted before reaching the mid-field. To clear runways as quickly as possible, the pilot is directed by radio to follow the white flashing ground signal. These lights are individually controlled by the push keys on the panel. They operate only as long as the keys are depressed.

The pilot of an airplane desiring to take off reports to the tower by radio; the dispatcher then gives the wind velocity and direction, and after referring to the anemoscope on the control panel indicates the runway to be used. The airplane then is maneuvered on the taxiway along the outside of the landing field to a position along side the runway assigned to take-off.

The dispatcher after selecting the runway in the manner already described for landing, sets the right-hand switch key for day operation if take-off is by day. With the airplane near position to take off and conditions on the field and over it satisfactory, the operator throws the middle cam key to "take-off." The red air signal near the plane taking off and the green ground signal at the near runway end are illuminated. The airplane is taxied into position and takes off. The red air signal warns airplanes aloft not to approach and the green ground signals give clearance to the one taking off.

Should an emergency arise or a faulty interpretation of signals be made by a pilot in either landing or taking off, so that an accident is imminent, the dispather can nullify his previous signal by operating the single red key of the group to the "emergency stop" setting, which disconnects the signal lights in operation and lights instead the red air signal and both the near and distant red ground signals. Thus the pilot of an airplane in the air, observing the red air signal, remains aloft and does not attempt a landing and one on the ground awaits further instructions from the tower before proceeding.

Three identical key groups on the tower control panel for runway selection are provided. By two of these, parallel runways may be controlled simultaneously, while the third allows the operator to have an alternate runway selection in reserve if a shift in the wind direction requires a change.

The circuit arrangement on the control system is such that the runway selector dial can be effective on only

one control group at a time, even though two or three left-hand keys should be operated to the "select" position. Provisions are also made in the circuit to prevent the selection of a runway that already has been selected by another control group, and to prevent any selection in case a number other than a runway designation is dialed. Moreover, the center and right-hand keys may be preset before dialing. In such case none of the lighting or signaling circuits will be completed before the left-hand key is returned to its normal "hold" position after the completion of the dialing operation.

To clear any one of the three groups preliminary to making another runway selection, the operator manipulates the left-hand key to the "release" setting, which clears the key group and de-energizes the relaying equipment, leaving it in condition for another selection. Since only parallel runways can be energized at the same time, it is impossible to energize intersecting runways or give conflicting signals.

Since the electric system of the Chicago airport comprises 158 individual signal and light circuits, operated in 104 separate combinations, the utility of the automatic control system can be appreciated. The electrical facilities have been designed to permit airplane movements to occupy virtually the undivided attention of the operator. With only a moment's glance at the illuminated control panel he can determine instantly which signals and lights are in operation, or ready to be placed in operation. With the exercise of ordinary precaution by pilots, it is believed that airplanes may be brought in and taken up from Chicago's airport with greater safety, security, and dispatch than at any other airport.

The Cyclotron

W. M. BROBECK

Possible relationships of the cyclotron to future engineering developments are considered in this article, which describes the development of atomic accelerating devices, the operating principle and construction of a typical cyclotron, and the uses to which it is now being put.

IT OFTEN HAPPENS that apparatus built for scientific investigation is the forerunner of equipment used in industrial plants. Because of this possibility for the cyclotron and because of the unusual electrical problems involved in its construction, a description of it should be of interest to electrical engineers.

The cyclotron is a device for the production of a beam of atoms traveling at high velocity. Its practical value arises from the effects of the impact of the atoms of the beam on the atoms of the material of the target which the beam strikes.

TYPES OF ATOMIC ARTILLERY

In 1919, Ernest Rutherford discovered that the collision of helium and nitrogen atoms resulted in the production of hydrogen atoms. In these experiments the helium atoms were obtained from the natural disintegration of radium and had kinetic energies of five to ten million electron-volts. As a result of the scientific importance of the transmutation of elements, a great demand arose for apparatus to accelerate atoms in larger quantities and to higher speeds than were obtainable from the radiation of naturally radioactive material. This demand has given rise to the development of several types of atomic accelerators, of which the cyclotron is the most powerful.

Fortunately the acceleration of atoms is basically a very simple process. The atoms of a gas, such as heavy or light hydrogen or helium, are generally used. The first step is to perform the process of ionization, which in the case of the gases mentioned means the removal of the electrons from the neutral gas atoms, leaving the positively charged nuclei. These nuclei are the actual bullets that are projected at the target under bombardment. Ionization usually is carried out by running an arc discharge in a confined space at a pressure of the order of 10^{-3} millimeter of mercury. In the arc the electrons are stripped by collision from some of the gas atoms, which subsequently diffuse through a small opening into the high vacuum of the accelerating chamber. A lighted filament is usually one electrode of the arc. The useful ion current, consisting of the bare nuclei of the element to be accelerated, is generally of the order of 100 microamperes, but may be "contaminated" with many times as many unwanted molecular ions and incompletely ionized atoms.

Acceleration of the ions is done most simply by maintaining the ion source at a positive potential with respect to the target. Such an accelerator is illustrated diagram-

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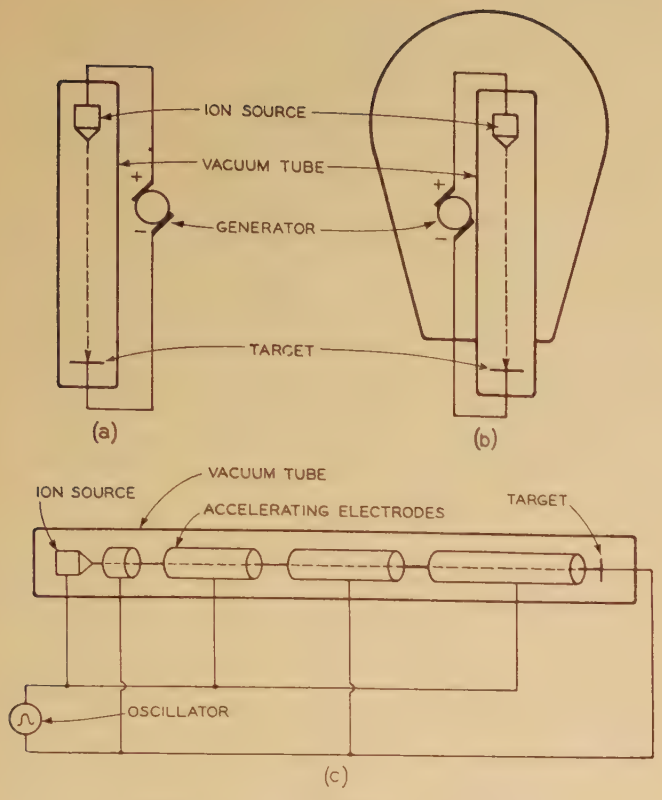


Figure 1. Types of linear accelerators

a. Conventional single stage *b. Pressure insulated single stage*
c. Multiple stage

matically in Figure 1a. The ions "falling" through the potential drop gain kinetic energy proportional to the product of their charge and the voltage difference through which they have passed. As the charge of the electron is a convenient unit, the energy is expressed in electron-volts. Hydrogen, having a one-electron charge, reaches the target with one electron-volt of energy per volt of potential difference, while helium, having a charge of two, attains two electron-volts per volt of potential difference.

As the energies per atom necessary to produce disintegrations of the target elements are of the order of a million electron-volts and higher, the problem in designing practical accelerators of the type described is to obtain the necessary high voltage. Above a million volts, insulation becomes very difficult. As a means of reaching higher voltages, the most recent accelerators of this type have been built inside tanks in which the air pressure can be increased to from 75 to 100 pounds per square inch, with corresponding ability to hold higher voltages than at atmospheric pressure. Figure 1b is a diagram of such a device. With this construction it is also possible to control the humidity of the air, or to use other gases, such as Freon, which permit still higher voltages. With such apparatus, ions have been accelerated up to 3,500,000 electron-volts and probably double that energy is possible in the near future. Power supplies for these accelerators are usually the Van de Graaff type, in which static charges are carried from ground to the insulated electrode by moving belts, in a modernization of the old "static machine" principles.

Another method of avoiding the difficulties inherent in high voltages is to apply a lower voltage a number of times in succession. One form of apparatus using this method is illustrated in Figure 1c. Voltage is applied to hollow electrodes by an oscillator at such a frequency that, as the ions cross each gap, the electrode ahead of the ion is always negative with respect to the electrode behind it. To make use of a single frequency, the electrodes are made successively longer, so that the ions take the same length of time to pass from each gap to the next as they are accelerated. Although this device avoids high voltages, it has not proved very practical, owing to the difficulties of transmitting high-frequency power and the long lengths that would be necessary for high energies.

THE CYCLOTRON PRINCIPLE

The cyclotron also makes use of the repeated application of a comparatively small voltage, but because of important differences from the linear type of apparatus just described, it has proved a practical means of obtaining the highest energies yet reached in the artificial acceleration of atoms. A diagram of the cyclotron is shown in Figure 2. In the cyclotron the acceleration takes place in a strong uniform magnetic field between the circular pole tips of a large electromagnet, the effect of which is to cause the ions to move in circular paths. The two accelerating electrodes are semicircular and hollow with the facing sides open, and the ion source is at the center of the gap between them. Alternating

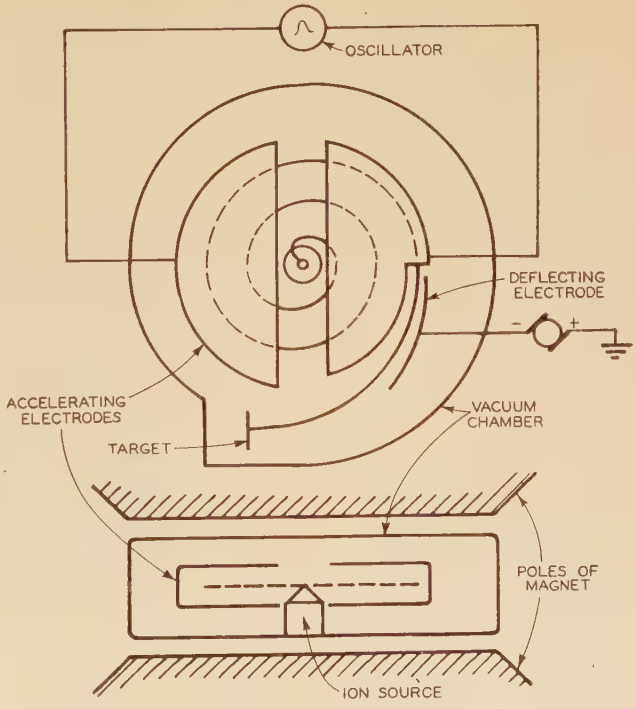


Figure 2. Schematic diagram of the cyclotron

voltage is applied across the electrodes by an oscillator at a frequency of the order of ten megacycles.

At the outside edge of one of the electrodes is an opening, beyond which is a deflecting plate supplied with a d-c voltage. The operation can best be understood by considering the journey of a single ion. When the ion leaves the ion source, it is attracted immediately toward whichever electrode is negative at the time. As it accelerates, it moves along a circle so that after half a turn it again reaches the gap. The frequency of the oscillator is set so that in the time required for the ion to travel the half circle the polarity of the electrodes has reversed and the ion is accelerated through the voltage difference between them and starts another semicircle of larger radius. As the increase in radius is proportional to the increase in velocity, the same time is always required for a half circle, so that the ion always finds itself approaching the negative electrode, and the acceleration continues until the outer radius of the electrodes is reached. Here the ion passes through the slot in the outer wall of one electrode into the electric field of the deflecting plate, which draws it farther from the center and directs it toward the target.

The operation is based on the resonance between the rotation of the ions and the frequency of the oscillator. This relation can be expressed as follows (symbols are explained in list at end of article):

$$f=\frac{1.52eH}{M}$$

In the case of the acceleration of heavy hydrogen ($e=1$ and $M=2$), f becomes ten megacycles for a magnetic field of 13 kilo-oersteds. Light hydrogen requires twice the frequency or half the magnetic field strength, while helium ions require practically the same values as those of heavy hydrogen.

Another important relation determines the energy as a function of the size of the cyclotron:

$$W=\frac{e^2H^2R^2}{3{,}240\ M}$$

or, for heavy hydrogen:

$$W=\frac{H^2R^2}{6{,}480}$$

The 60-inch cyclotron at the University of California, Berkeley, the largest now in operation, runs at 13 kilo-oersteds and has a 25-inch accelerating radius, making the energy of the beam 16 million electron-volts when heavy hydrogen is accelerated.

From the simple theory as stated there would appear to be no limit to the possible multiplication of the electrode voltage, a lower voltage merely requiring a greater number of revolutions. However, the electrode voltage must in practice exceed a definite minimum for the atoms to reach the target. Two conditions determine the minimum accelerating voltage required. The first is the necessity for focusing the ions into the median plane between the magnet-pole faces. This is done by decreasing by one or two per cent the magnetic field strength at the outer radius. The second is the effect of the increase in mass of the atoms as they travel at speeds approaching the speed of light. As a result of these conditions, the resonance relation cannot be maintained over the entire path, and the ions must gain or lose with respect to the rotation of the vector of the electrode voltage. As this phase error is a function of the number of revolutions and cannot exceed 90 degrees (beyond which the ion is decelerated), the number of revolutions is definitely limited. This limit can be best expressed by the electrode voltage required, which is a function of the final energy of the beam:

$$V=\frac{236W^2}{Me}$$

Since the voltage required thus increases as the square of the energy, the oscillator becomes more of a problem in larger cyclotrons. To accelerate heavy hydrogen atoms to 100 million electron-volts, a voltage of 1,200,000 is required between the accelerating electrodes. Even with the most efficient design, several hundred kilowatts are required to excite the electrodes at this voltage.

A TYPICAL CYCLOTRON

Each of the 30 or so cyclotrons now being built or in operation in the United States and elsewhere has been designed independently, so that it is hardly possible to discuss typical cyclotron construction. However, the 60-inch cyclotron at the University of California (Figure 3) is an example of one of the ways in which the various mechanical and electrical problems inherent in this apparatus have been met.

The largest part is, of course, the magnet. As cyclotron size is generally expressed by the diameter of the tip of the magnet poles, the dimension in this case is 60 inches. The magnet core is 16 feet long, $11\frac{1}{2}$ feet high, and 6 feet wide, and is assembled from 2-inch plates for the rectangular frame, with 10-inch-thick disks for the poles. The weight of steel in the core is 190 tons. The magnet is wound with 22 tons of $\frac{1}{8}$ by $2\frac{7}{8}$ copper strip in 12 spiral coils, 6 on each side of the gap. The coils are immersed in oil circulated through a heat exchanger in a 200-gallon-per-minute cooling tower. Power is supplied by a 75-kw motor-generator set, the excitation of which is controlled through an electronic circuit which holds the magnet current to one part in 5,000.

The system supplying the voltage to the accelerating electrodes consists of a rectifier with its power transformer and control, a vacuum-tube oscillator, transmission lines, and the electrode supports and housing. A circuit diagram of the complete system is shown in Figure 4. Four hundred and forty-volt three-phase power is supplied through the main contactor to a monocyclic constant-

current network with Pyranol capacitors and fixed iron-core reactors. The number of capacitors in circuit can be varied through relays for voltage control. The voltage is stepped up to 17,000 and applied to a six-tube three-phase rectifier. The rectifier tubes, of the glass mercury-pool type, are "home made" and have been the subject of much experimentation. Two hundred kilowatts at 20,000 volts d-c can be applied to the plates of the oscillator tubes, which operate in push-pull. These tubes, also made at the laboratory, are continuously pumped and have water-cooled filament supports and grids, as well as water-cooled anodes. The circuit components consist of a resonant line-grid circuit and a coil and variable capacitor in the plate circuit. The transmission lines to the cyclotron proper are made of concentric copper tubes having diameters of 2 and 15 inches and are connected to the oscillator tubes through vacuum capacitors. The tubular supports for the accelerating electrodes inside the vacuum are made the proper length to resonate at the operating frequency, so that their outer ends, being at a voltage node, can be supported rigidly without the use of insulators. The connections from the transmission lines are made through insulators which are subjected to only a small fraction of the voltage appearing on the electrodes. As large radio-frequency currents circulate on the surfaces of the electrodes, supporting tubes, and housings, these surfaces are covered with copper sheet to which water-cooling tubes are soldered. The entire power input of 200 kw maximum to the oscillator must be carried away through the water-cooling system.

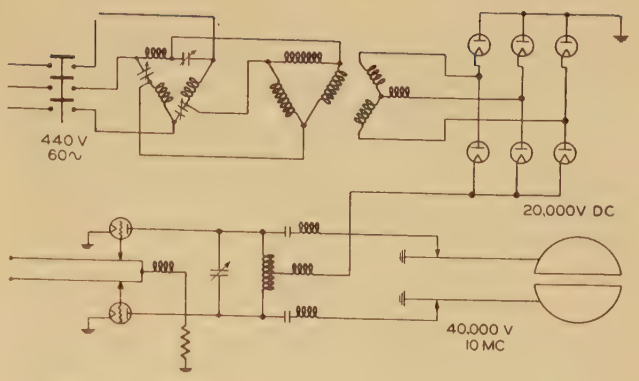


Figure 4. Circuit of the oscillator and its power supply

As the accelerating process must proceed under vacuum, which also aots as insulation against the high voltages developed, the entire system must be contained in a vacuum-tight envelope, familiarly referred to as the "tank." This consists of a bronze casting between the magnet poles, the top and bottom covers of which are of iron and act as extensions of the magnet poles, and welded steel tubes outside the magnetic field. Some 70 ports and fittings, all sealed with double rubber gaskets, are used for access and connections to electric and cooling circuits. With the oil-diffusion pumps used, the volume of 120 cubic feet can be pumped down to the required vacuum of about 10^{-5} millimeter of mercury in three hours.

The ion source uses a tungsten filament of 80-mil diameter heated by 200-kilocycle current to prevent its failure from mechanical forces resulting from operation in the magnetic field. As the life of the filament averages only about ten hours, it is removed through a lock without breaking the main vacuum. Deflection of the beam is produced by a deflector plate maintained at 100 kv by a voltage-doubler circuit immersed in oil. The plate is cooled by circulating through it the oil used for insulating its power supply. The deflector plate is supported by a tube insulated from and mounted inside one of the accelerating-electrode support tubes, so as to be shielded from the radiofrequency field of the accelerating electrode.

The target against which the atomic beam impinges is mounted in a subsidiary chamber provided with a gate that can be closed to permit changing targets without breaking the main vacuum. As the beam current at times reaches 300 microamperes at 16 million volts, the corresponding 4.8 kw de-

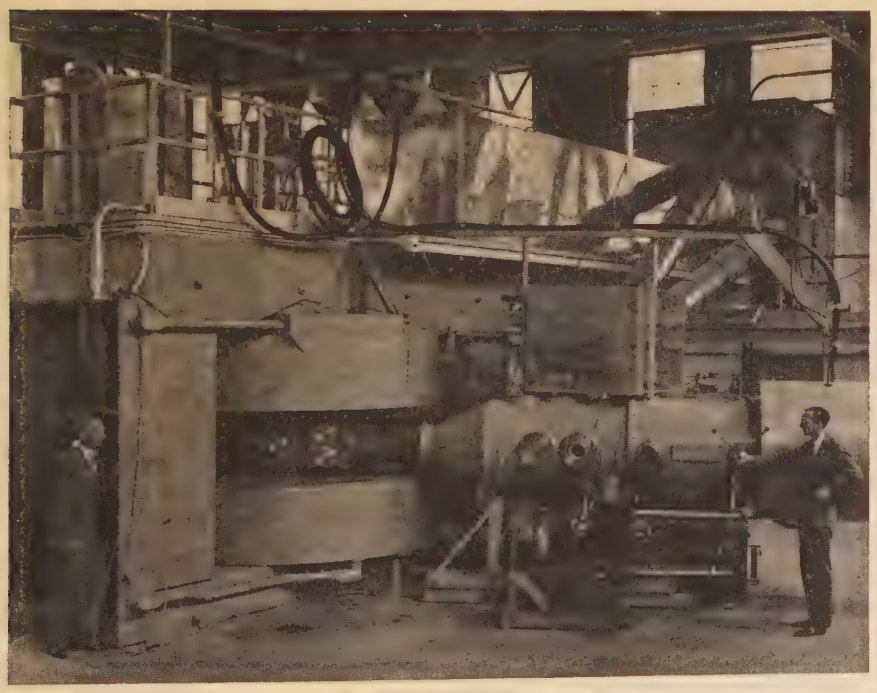


Figure 3. The 60-inch cyclotron at the University of California

The magnet frame and housings for the electrode supports can be seen. The rectangular boxes above the magnet are the enclosures of the resonant grid line and the oscillator. Temporary pumping apparatus is in the foreground

veloped at the target requires rather elaborate cooling arrangements, especially as the specific heat dissipation reaches 10 kw per square inch.

The operating controls for the cylotron are located in a room about 40 feet from the magnet, and to this position is brought indication of the voltages, currents, and powers in the various circuits and particularly of the current in the beam of high-speed atoms reaching the target. The latter indication is obtained by insulating the target and observing the current which flows from it to ground as the atoms give up their charges to the target. In the electronic power and control apparatus associated with the cyclotron, over 50 vacuum tubes are used for various purposes.

The radiation produced while the cyclotron is in operation, and from the targets and any other parts struck by the beam, necessitates precautions against danger to the operators. The cyclotron itself is surrounded on the sides and top by tanks of water from $3^1/_2$ to 5 feet thick to stop the radiated neutrons. In addition, several inches of lead shielding are used in some places. "Active" targets that have been bombarded recently must be handled at a distance and stored in radiation-absorbing enclosures. In addition, the operators carry instruments to record their exposures.

THE 184-INCH CYCLOTRON

The 60-inch cyclotron at the University of California has been in operation since March 1939, and often has run 24 hours a day for considerable periods, owing to the demand for radioactive materials and for its use in medical, biological, and physical experiments. Its success and the promise of new discoveries at still higher energies made the construction of a much larger cyclotron appear possible and desirable. Accordingly, with a grant from the Rockefeller Foundation, the University of California is proceeding with the construction of a cyclotron having a pole-tip diameter of 184 inches. An artist's sketch is shown in Figure 5. The magnet will stand 30 feet above its base, be 56 feet long, and contain 3,700 tons of steel and 300 tons of copper. An initial installation of 2,500 kw for the oscillator and 400 kw for the magnet is to be made. Completion of the magnet is scheduled for the spring of 1942, and it is hoped that the complete apparatus will be in operation by the summer of 1943. An atomic beam of 100 million volts energy is expected from this cyclotron. Such a beam has a penetrating power of 140 feet of air, compared to about 5 feet for the 16-million-volt beam of the 60-inch cyclotron. The potentialities of such energy in atomic disintegration appear to be considerable.

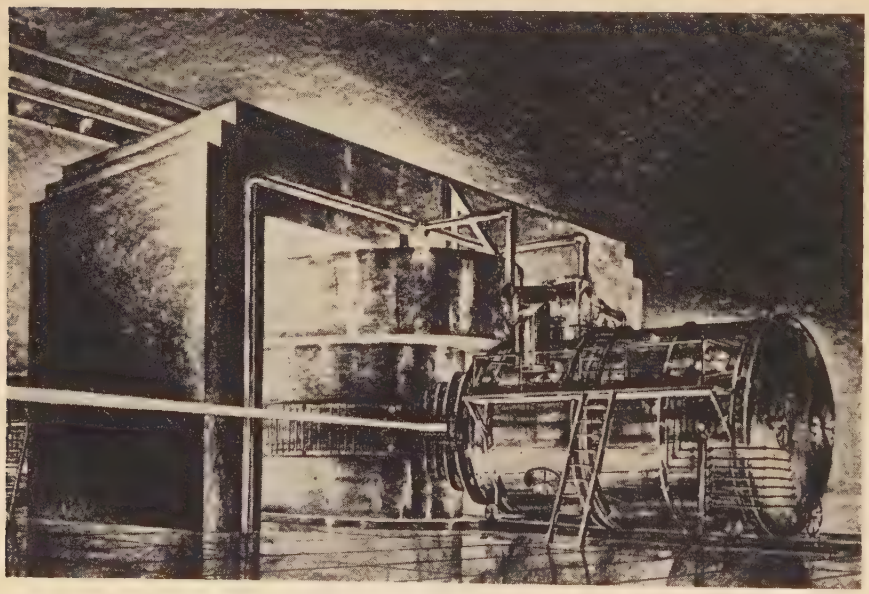


Figure 5. Artist's sketch of the 184-inch cyclotron now under construction at the University of California

USES OF THE CYCLOTRON

Although this article is concerned primarily with the engineering features of the cyclotron, some consideration also may be given to the purposes served by thus building apparatus weighing thousands of tons. To make clear the uses of the cylotron, it is first necessary to explain the sort of radiation that is produced when the atoms of the beam collide with those of the target at speeds approaching the velocity of light.

The important part of the atom is the nucleus, which even in the densest materials occupies only an infinitesimal proportion of the volume of the substance but which determines the nature of the element. The particles of the beam from the cyclotron, usually consisting of the nuclei of hydrogen atoms, penetrate the material of the target to a depth of a few millimeters, and perhaps one in a million makes a hit on a nucleus of an atom of the target material. (The remainder are brought to a stop by collisions with electrons, which do not concern us here.) In the collision, the atomic projectile appears to be captured by the target nucleus, and very often a piece of nuclear matter, that is, one or more protons or neutrons, is given off. When the weights of the particles captured and emitted are considered, the result shows that the atoms of the target must have been changed to those of another element or another form (isotope) of the same element. However, this weight calculation usually reveals a small discrepancy of the order of 1/10,000 of the total weights of the particles involved, and this difference, converted into equivalent energy units by the use of the relation between mass and energy, can be shown to appear

as the difference between the kinetic energies of the bombarding particle and the products of the collision.

The emitted neutrons, having no electric charge, possess great penetrating ability, comparable to that of X rays, while the protons, being similar to the bombarding atoms, can be stopped by a few millimeters of solid material. Moreover the neutrons can again act as bombarding projectiles on other targets, and this results in secondary transmutations. Self-sustaining chain reactions of this type, releasing appreciable quantities of atomic energy, are theoretically possible and constitute one strong reason for the encouragement of research at higher bombarding energies.

The new elements or isotopes may be formed in an unstable condition, from which they eventually will return to a stable form. This return is accomplished by the ejection of a positive or negative electron and often results in the production of high-energy X rays or gamma rays. This process is the same that occurs naturally in radium and its derivatives; hence it is called artificial radioactivity. Such radioactive substances can be followed through any physical or chemical changes by observing their emitted radiation. This use of radioactive atoms as tracers has caused them to be popularly known as "tagged atoms." By bombarding available target materials, it is possible to obtain all the 92 elements in radioactive form and even to prepare the radioactive form of what is almost certainly element 93.

These atomic phenomena are the basis of the use of the cyclotron in the fields of physics, medicine, physiology, and biology. In physics, the study of the forms and behavior of the nuclei of atoms is an extremely broad field, dependent to a large extent on the cyclotron. In medicine, the cyclotron is used in the production of neutron rays directly from the target under bombardment for experiments in cancer treatment. Radioactive materials made by the cyclotron are given to patients to expose the body to internal radiation. In physiology and chemistry, the use of artificial radioactive substances as tracers in life processes and reactions, where groups of atoms must be differentiated from others of the same element, has been of great value in studying such problems as the absorption of fertilizers from soil and the action of plants in synthesizing carbon dioxide and water into carbohydrates. Just as atomic projectiles are used in discovering the structure of the atomic nuclei, they are also of value in studying the nuclei of cells through the effects of the damage and rearrangement caused to the cell parts on exposure to radiation. (See also "Atom Smashing and Its Applications to Medicine," Robley Evans, *Electrical Engineering*, volume 60, June 1941, pages 250–60.)

FUTURE OF THE CYCLOTRON

Up to the present, the cyclotron has been used principally on scientific rather than engineering problems. Its importance to engineering appears to be in the future development of the scientific fields to which it contributes. Metallurgy and chemical engineering undoubtedly will make routine use of radioactive tracers when more cyclotrons are operating to prepare these materials. But the greatest potentialities lie in the direction of the release and control of the energy locked up within the atom. Dreams of such happenings as steamships crossing the oceans on a cupful of fuel, while still very far from realization, are becoming less visionary through the study of the inner structure of the atom—a study that depends on atomic projectiles of the highest velocity which can be produced only by the cyclotron.

LIST OF SYMBOLS

f = oscillator frequency—megacycles per second
e = electric charge on accelerated particle—electrons
H = magnetic field strength—kilo-oersteds
M = mass of accelerated particle—mass of proton = 1
R = maximum accelerating radius—inches
W = maximum energy of beam—million electron-volts
V = accelerating voltage (peak voltage between accelerating electrodes)—volts

History of Electrical Resonance

Our earliest knowledge of electricity was of the static kind; later came the voltaic cell and direct current. But not until the discovery of alternating or oscillating currents could the phenomenon of electrical resonance make its appearance. Today, as we turn the dials of our radio receivers and "tune in" on the station we want it is recognized how widespread the application of electrical resonance has become. Nevertheless, it seems that few have given thought as to how this important principle came to light and how and when it came into common use.

In an article "The History of Electrical Resonance" published in the October 1941 issue of the *Bell System Technical Journal* (pages 415–33), Julian Blanchard of the technical consulting staff, Bell Telephone Laboratories, New York, N. Y., reviews the early history of the phenomenon. He shows how electrical resonance had its roots in certain experiments with the Leyden jar; how the results of experiments were clarified by mathematical analysis and a correct theory formulated; and then, as the need and opportunity arose, how the principle was applied by inventive minds. "It hardly seems necessary," says the author, "to pursue the subject further than this point, considering how it so quickly thereafter became a commonplace item in our electrical storehouse."

The article includes a list of 32 references to early writings on the subject, which includes several papers by AIEE Past President M. I. Pupin.

Wind Shielding of Parallel Conductors

G. D. SHECKELS
ASSOCIATE AIEE

THE usual method of determining the wind loading of a conductor group is to multiply the wind load on a single conductor by the number of conductors on a crossarm. This does not take into account any possible shielding of the leeward conductors by the windward conductors. On straight lines, the only transverse load is the wind load; and if this wind load were actually less because of the shielding effect, the maximum design strength of the line could be reduced with a corresponding decrease in construction cost.

Experience and previous laboratory investigations have indicated the existence of wind-shielding effects in groups of parallel conductors of distribution lines, in which the leeward conductors are shielded by the windward conductors. This article reports the results of wind-tunnel tests to determine the magnitude of the factors controlling the wind-loading on groups of parallel conductors.

The existence of the wind-shielding effect has been indicated by experience with actual lines and by laboratory investigations. In several cases, lines have experienced wind velocities much greater than the maximum velocities for which they were designed. Yet the lines did not come down as expected, and the apparent additional strength could be explained only if some such element as wind shielding were involved.

The first laboratory investigations were concerned primarily with aeronautical work. In 1915, the British Advisory Committee for Aeronautics,[1] using a wind tunnel, measured the shielding effect of two one-half-inch diameter rods with spacings up to 6 diameters. A similar investigation with spacings up to 15 diameters was carried out in 1916 by T. Wong and T. Yu[2] at the Massachusetts Institute of Technology. Both of these investigations showed that there was a shielding effect in the range studied. In 1923, P. J. Howe[3] reported data collected on an outdoor model telegraph line. This investigation was limited to a standard one-eighth-inch conductor and $11^3/_4$-inch spacing as used on telegraph lines, but it showed clearly that shielding was present for that particular diameter and spacing. The National Electrical Safety Code,[4] in 1927, added the following to its rules for heavy and medium loading:

". . . For supporting structures carrying more than ten wires not including cables supported by messengers, where the pin spacing does not exceed 15 inches, the transverse load shall be calculated on two thirds of the total number of wires with a miminum of ten wires."

Since power-distribution lines seldom have as many as ten conductors, this allowance, in general, is limited to communication lines. In 1936, the Edison Electric Institute[5] studied storm loading on an actual distribution line, and the shielding effect was one of the factors investigated. The EEI investigators suggested that wind shielding occurred only when a wind gust first struck the line, but they also stated that more data would be desirable before a definite conclusion is drawn. During the 1938 New England hurricane, the wind-shielding effect again was noticed, by the New England Power Association. At the suggestion of engineers of that company, the author selected the wind-shielding problem for a thesis subject at the Massachusetts Institute of Technology.

EXPERIMENTAL INVESTIGATION

For this investigation, a model distribution line was set up in the five-foot MIT wind tunnel. The model consisted of a group of $1^1/_8$-inch by $4^1/_2$-foot varnished wooden rods which simulated ice-coated conductors. All but one of the rods were supported in a sheet-metal angle frame as shown in Figure 1. One rod was supported independently of the frame, and all drag measurements were made on this rod. Different groupings were obtained by changing the positions of the rods in the

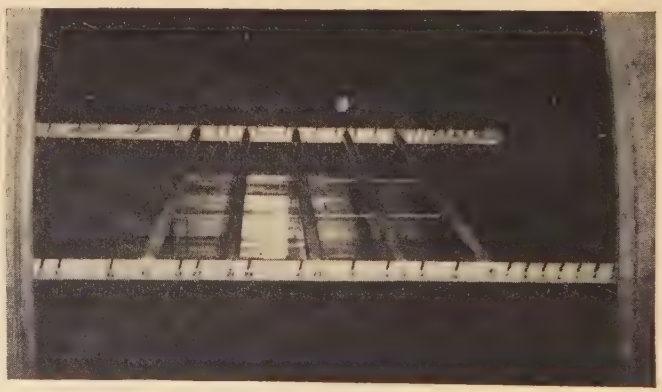


Figure 1. Model setup in wind tunnel; drag measurements made on left-hand rod

Paper presented at a meeting of the AIEE Seattle Section, December 1940, and subsequently awarded the AIEE District 9 prize for initial paper for that year.

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The author acknowledges the suggestions and guidance of Professor L. F. Woodruff and J. W. McBride of the Massachusetts Institute of Technology.

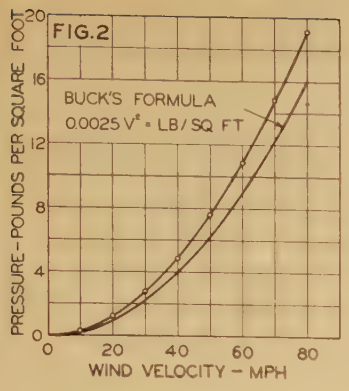


Figure 2. Effect of wind velocity on drag of single rod

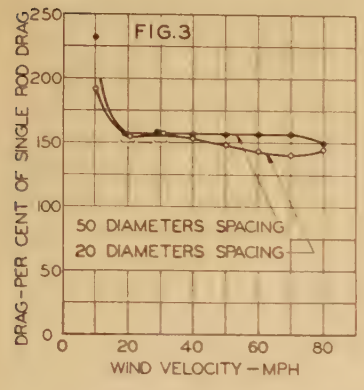
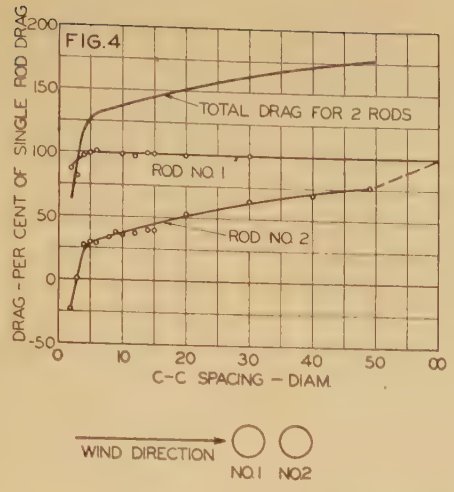
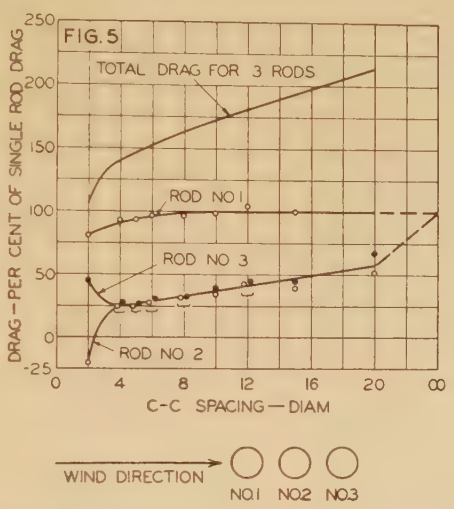
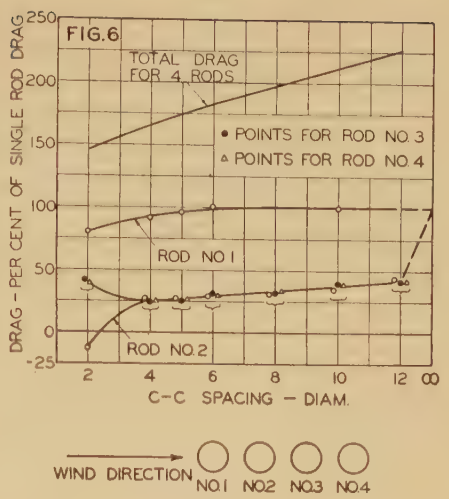
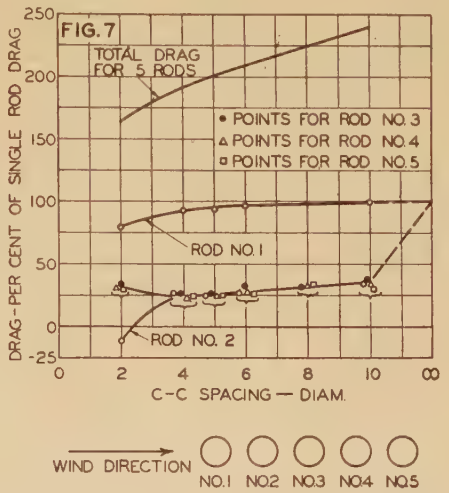


Figure 3. Effect of wind velocity on total drag of two rods









Figures 4–7. Variation in individual drags of two, three, four, and five rods, obtained by increasing the horizontal spacing while maintaining the wind velocity constant at 60 miles per hour

frame with respect to the measured rod. All drag measurements were made with the standard wind-tunnel balances and drag systems, and the wind velocity was measured with a National Advisory Committee for Aeronautics micrometer manometer.

As a basis for comparison, measurements of drag versus wind velocity were made on a single rod as shown in Figure 2. The difference between H. V. Buck's curve and the experimental curve is probably due primarily to the fact that Buck's curve is based on stranded cable while a smooth rod was used for the experimental curve. In Figure 3, the effect of wind velocity on the shielding is shown for two rods at spacings of 20 and 50 diameters. Since the percentage drags were fairly constant over the greater portion of the curves, it was decided to run all the succeeding tests at a velocity of 60 miles per hour.

Figures 4, 5, 6, and 7 show the individual drag of each rod of the two-, three-, four- and five-rod groups. Several interesting points may be noticed from these curves. First, at spacings less than five or six diameters, the drag on the first rod is reduced by the presence of the rod or rods to the leeward of it. This reduction is probably caused by the slowing down of the air stream in front of the second rod.

Another point is that the slope of the drag curve for the second rod changes abruptly at spacings of about four or five diameters and the drag becomes negative at spacings less than three diameters. This is most easily explained by fluid-mechanics theory. When a fluid flows past a rod, eddies are formed on the downstream side of the rod. The eddies break off from alternate sides of the rod at a definite frequency and move downstream at a velocity less than that of the surrounding stream. This wake is termed a Kármán vortex trail and has been photographed at a Reynolds' number of 250.[6] This is relatively low when compared with the Reynolds' number of 54,000 obtained in the author's tests, but it is believed that the formation of the eddies is of the same general character in both cases. If a second rod is placed in the wake close to the first rod, the eddies produce circulation around the first rod as shown in Figure 9. This circulation acting in conjunc-

tion with the instantaneous stream produces a lift force as shown in the figure. On the upper right-hand side of the second rod, the circulation bucks the stream, producing a low-velocity and high-pressure area; while on the lower left-hand side, a high-velocity and low-pressure area is formed. Thus the lift force acts downward and to the left. The stream itself produces an instantaneous drag on the rod downward and to the right. Because of the greater net circulation at close spacings, the horizontal component of the lift might be greater than the horizontal component of the drag; and since the horizontal forces were the only ones measured, this would account for the negative measured drag.

Figure 9 shows the circulation about the second rod at an instant when a lower eddy is closer to the rod. An instant later an upper eddy will be closer and the circulation will have reversed. This causes the vertical components of lift and drag to act in an upward direction. As each succeeding eddy passes, the vertical components change, thus producing an alternating force on the rod. This vertical vibration of the second rod was observed during the tests at the closer spacings. As the spacing between the first and second rods is increased, the eddies are weaker and farther apart as they pass the second rod. This reduces the net circulation and the resulting lift, and by the time the spacing has reached four or five diameters, the net circulation has become negligible. Beyond five diameters the only force on the second rod appears to be the drag caused by the moving air in the wake. The mean velocity of the wake increases very slowly and even at 50 diameters out, it is still considerably below the velocity of the surrounding air. The velocity and resulting drag reach 100 per cent somewhere beyond 50 diameters.

Another point to be noticed in Figures 5, 6, and 7 is the behaviour of the third, fourth and fifth rods. When circulation occurs about the second rod, the uniformity of the wake is destroyed and considerable mixing takes place behind the second rod. High-velocity air is drawn in from the surrounding stream and the drags on the succeeding rods are higher because of the increase in mean velocity of the wake. As the spacing is increased, the net circulation about the second rod decreases. This also decreases the mixing which in turn lowers the mean wake velocity and the drag on the succeeding rods. By the time the spacing has reached five diameters, the net circulation has become negligible and the uniform wake acts on all the rods alike. From five diameters on out, the drags on the leeward rods are approximately the same and increase equally with an increase in spacing.

Referring again to Figures 4 to 7, the second, third, fourth, and fifth rods between four and ten diameters spacing appear to have approximately the same drag regardless of the number of rods in the group. On this premise, it might also be expected that the drag curves would coincide out beyond 10 diameters. The drags of third, fourth, and fifth rods at spacings up to 50 diameters could then be estimated by extrapolating the curves out along the second-rod curve of Figure 4.

Figure 8 shows the effect of changing the wind direction with respect to the plane of the rods. At a horizontal spacing of 12 diameters, the shielding is eliminated at a vertical spacing of only four diameters; and at a 52-diameter horizontal spacing, at five diameters. Although these curves are for two rods only, they give an indication of the effect on a larger group of rods. In the actual design of a distribution line with the shielding effect taken into account, it is essential that the conductors be strung uniformly so that they all lie in a plane parallel to the wind direction. Also, a strength reduction because of shielding should be used only where the line is erected on flat ground and where there is little chance for the wind to blow up under or down upon the line.

APPLICATIONS

With consideration of the above limitations, the results of this investigation show that a shielding effect may be expected in distribution lines. For example, take a low-voltage distribution line of four number-4 weatherproof conductors spaced at 30 inches. The diameter of the conductor itself is about 0.31 inch; and with a 0.50-inch coating of ice, the diameter is increased to 1.31 inches. The spacing is then 22.9 diameters. From Figure 6, extrapolating as mentioned before, the total wind load is (3) (55)+100=265 per cent of the single-conductor wind load. This would give a reduction of 33.8 per cent on the usual pole-strength requirements. In high-voltage transmission lines, the spacing is usually about 250 diameters so that the shielding effect is probably negligible.

As noted in the foregoing distribution-line example, the wind loads on the leeward conductors are 55 per

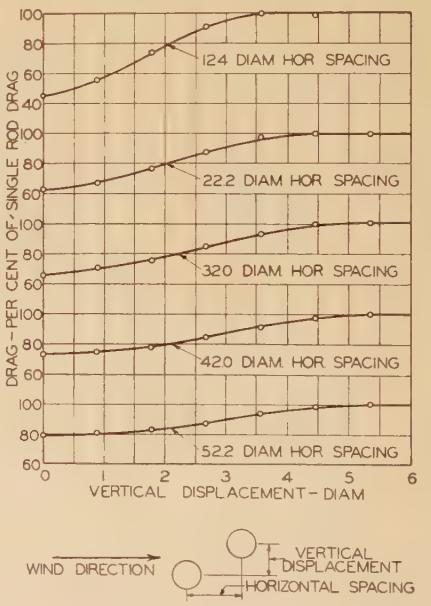


Figure 8. Variation in drag of second rod obtained by increasing the vertical displacement of the first rod and the horizontal spacing between rods, while maintaining the wind velocity constant at 60 miles per hour

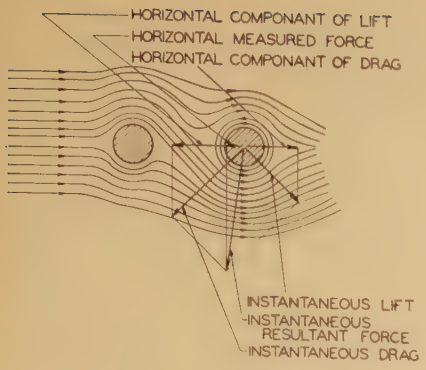


Figure 9. Forces on second rod caused by air flow about two rods at close horizontal spacings

cent of the single-conductor load. At 56.5 miles per hour, this would give an actual load of

$(0.55)\ (8) = 4.4$ pounds per square foot

or

$(4.4)\ (1.31/12) = 0.481$ pound per linear foot of conductor

The load on the windward wire would be

$(8)\ (1.31/12) = 0.874$ pound per linear foot

The weight of the conductor and its ice is

$0.128 + (0.31 + 0.5)\ (\pi)\ (0.5)\ (57.3)\ (1/144) = 0.634$ pound per foot

Then the resultant load for each shielded conductor is

$\sqrt{(0.481)^2 + (0.634)^2} = 0.80$ pound per foot

and for the unshielded conductor

$\sqrt{(0.874)^2 + (0.634)^2} = 1.07$ pounds per foot

Thus the shielding action gives a 25-per cent reduction in the resultant load on each leeward conductor. Since the conductor tension is proportional to the load for a constant sag, it follows that the leeward conductors could be designed with a 25-per cent reduction in maximum design tension. This would allow the use of conductors with less unit strength or with less cross-sectional area on the leeward side. Because it would be impossible to tell from which side the wind might come, it would be necessary to have both outside wires designed for full strength.

In actual practice, the wind is sometimes gusty at velocities as high as 60 miles per hour and the windward conductors might whip about and expose the leeward conductors. The whipping action depends on the weight of the conductor, the span length, and the general character of the wind in the particular locality. In some cases, the whipping might even nullify the shielding effect.

CONCLUSIONS

1. There is an appreciable shielding effect in the laboratory models of distribution lines.

2. At spacings of 20 diameters, the shielding increases slightly with an increase in velocity; but with 50 diameters spacing, the shielding stays fairly constant.

3. In the laboratory model, the shielding is eliminated at some spacing greater than 50 diameters.

4. In the laboratory model, the drag of the windward conductor is affected by the presence of a leeward conductor at spacings less than five diameters, and is not affected at spacings greater than five diameters.

5. The curves indicate that at any given spacing within the range of distribution line practice, the leeward conductors have approximately the same wind load regardless of the number of conductors or the relative position of the particular conductor, as long as the axes of the conductors lie in a plane parallel to the wind direction.

6. The angle between the wind direction and the plane through the axes of the conductors is a very important factor affecting the shielding. In practice, if the design strength of the line is to be reduced because of shielding, the conductors should all have the same sag and the terrain should be such that there would be little chance of the wind blowing up under or down upon the conductors.

7. Of interest to aeronautical engineers is the region between one and five diameters. This region merits further investigation both experimentally and mathematically.

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INSTITUTE ACTIVITIES

NATIONAL • • • •

Pacific Coast Convention to Be Held in Vancouver, B. C., September 9–11

Arrangements are being made for the Pacific Coast Convention which will be held in Vancouver, B. C., September 9–11, 1942. Convention headquarters will be in the Hotel Vancouver.

Since both Canada and the United States are concerned chiefly with the successful prosecution of the war, the local technical program committee has developed a program of a practical rather than a theoretical nature, directed along lines that will be helpful to members in their war effort. Tentative plans include four sessions on the subjects of system operation, apparatus, system planning, and industrial applications. In addition, there will be one or two student technical sessions, and there are prospects of a conference session.

The personnel of the 1942 Pacific Coast convention committee making the arrangements is:

H. J. MacLeod, *chairman;* C. A. Price and T. Ingledow, *vice-chairmen;* C. Arnott, *secretary;* F. V. Knight, *treasurer;* M. S. Barnes, F. J. Bartholomew, D. L. Brown, T. F. Hadwin, G. K. Haspel, K. L. Howe, A. C. Kelm, H. H. Krueger, G. L. Lane, F. C. Lindvall, F. W. MacNeill, G. F. Maughmer, C. J. Nevitt, E. W. Schilling, W. C. Smith, J. M. Somerville, J. H. Steede, J. A. Tames, A. L. Taylor, E. M. Wright.

Chairmen of the subcommittees are:

T. Ingledow, *entertainment;* W. D. Robertson, *registration and reception;* L. B. Stacey, *technical program;* A. Vilstrup, *finance;* T. H. Crosby, *golf;* T. C. Clarke, *transportation;* W. B. Coulthard, *student activities;* V. W. M. Fouracre, *publicity.*

Officers for 1942-43 Announced at Summer Convention

Officers of the Institute for the year beginning August 1, 1942, were announced in the report of the committee of tellers presented at the annual meeting, during the recently concluded summer convention at Chicago, Ill. The new officers are:

President: Harold S. Osborne, plant engineer, operation and engineering department, American Telephone and Telegraph Company, New York, N. Y.

Vice-Presidents: K. B. McEachron, research engineer, General Electric Company, Schenectady, N. Y. (District 1, North Eastern); C. R. Jones, eastern transportation manager, Westinghouse Electric and Manufacturing Company, New York, N. Y. (District 3, New York City); A. G. Dewars, manager, system planning department, Northern States Power Company, Minneapolis, Minn. (District 5, Great Lakes); E. T. Mahood, engineer, Southwestern Bell Telephone Company, Kansas City, Mo. (District 7, South West); E. W. Schilling, professor and head of the department of electrical engineering, Montana State College, Bozeman (District 9, North West).

Directors: W. R. Smith, safety engineer, electric department, Public Service Electric and Gas Company, Newark, N. J.; K. L. Hansen, consulting electrical engineer, Harnischfeger Corporation, Milwaukee, Wis.; W. B. Morton, senior field engineer, Philadelphia Electric Company, Philadelphia, Pa. (re-elected).

National Treasurer: W. I. Slichter, professor emeritus of electrical engineering, Columbia University, New York, N. Y. (re-elected).

The board of directors for the administrative year beginning August 1, 1942, will consist of these newly elected officers; C. M. Laffoon, engineering manager, a-c generator engineering department, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., who was elected by the board at its meeting May 22, 1942, as a director to fill the unexpired term of R. E. Hellmund, deceased; and the following holdover officers:

D. C. Prince, Schenectady, N. Y. (*retiring president*); R. W. Sorensen, Pasadena, Calif. (*junior past president*); N. S. Hibshman, Bethlehem, Pa.; J. E. Housley, Alcoa, Tenn.; A. L. Jones, Denver, Colo.; C. A. Price, Hamilton, Ont.; W. R. Smith, San Francisco, Calif. (*vice-presidents*); T. F. Barton, New York, N. Y.; M. S. Coover, Ames, Iowa; Mark Eldredge, Washington, D. C.; L. R. Gamble, Spokane, Wash.; T. G. LeClair, Chicago, Ill.; F. R. Maxwell, Jr., Pensacola, Fla.; F. J. Meyer, Oklahoma City, Okla.; R. G. Warner, New Haven, Conn. (*directors*).

A detailed report of the 1942 summer convention is scheduled to appear in the August issue.



Steamer trips on Howe Sound, at Vancouver, B. C., are among the recreational attractions of the forthcoming AIEE Pacific Coast convention, to be held at Vancouver September 9–11, 1942

Board of Directors Meets

The regular meeting of the board of directors of the American Institute of Electrical Engineers was held at Institute headquarters, New York, N. Y., May 22, 1942.

Lieutenant General Andrew G. L. McNaughton was elected an Honorary Member of the Institute by unanimous vote of all present. (Affirmative ballots in writing from absent members of the board subsequently consummated the election, as required by the constitution. A biographical sketch of General McNaughton appears on page 363.)

Resolutions were adopted in memory of Past President Bion J. Arnold and Director R. E. Hellmund (published in June *Electrical Engineering*, pages 319 and 320).

C. M. Laffoon, East Pittsburgh, Pa., was elected a director of the Institute for the unexpired term, ending July 31, 1943, of R. E. Hellmund, deceased.

The annual report of the national treasurer for the fiscal year ending April 30, 1942, was presented and accepted.

The annual report of the board of directors for the fiscal year ending April 30, 1942, as prepared under the direction of the national secretary, was approved for presentation at the annual meeting of the Institute, on June 22, subject to any changes suggested by members of the board prior to the printing date (see pages 368–81).

The report of the committee on award of Institute prizes on the prizes awarded for papers presented in 1941 was presented (published on page 311 of the June issue of *Electrical Engineering*).

The board confirmed applications, upon recommendation of the committee on research, to The Engineering Foundation for continued support for the year beginning October 1, 1942, of the following research projects sponsored by AIEE: Project 74, Insulating Oils and Cable Saturants; Project 62, Welding Research Committee (sponsored jointly by AIEE and the American Welding Society).

Authorization was given for reimbursement to the Engineers Defense Board of the Institute's share, $110, toward out-of-pocket travel expense incurred in connection with the preparation, for the War Production Board, of a report on copper production.

Upon invitation of the Utah Section and recommendation of the District officers concerned, the board approved Salt Lake City, Utah, as the location for the Pacific Coast convention previously authorized to be held about September 1, 1943.

The following statement of scope of activity of the recently established technical committee on applications of electricity to therapeutics was approved:

"Treatment of all matter in which the dominant factors are the application of electric power to sanitation equipment, such as air-cleaning and sterilizing devices, and to the promotion of health and the analysis and treatment of disease or defects of the human body, such as X-ray equipment, diathermic equipment, cardiographs; investigations not directly applying to the human body but relating to health, and electric devices suitable for such purposes; the study of harmful effects of electric currents and radiations of electric devices upon the human body and means for the prevention of such effects, etc., are properly within the scope of this committee.

"Where certain devices are suitable for both therapeutic and industrial purposes, such as some X-ray equipment, or for therapeutic and other scientific investigations, or for sanitation and air-conditioning of domestic and commercial premises, action shall be joint with the committee on industrial power applications, the committee on basic sciences, or the committee on domestic and commercial applications, respectively; also, when appropriate, with the committee on safety."

Approval was given to the following appointments of AIEE representatives recommended by the standards committee:

Frederick G. Willis, on the Committee on Recording and Reproducing Apparatus being organized by the National Association of Broadcasters;

L. C. Ilsley, reappointment on the Mining Standardization Correlating Committee for the two-year term beginning January 1, 1942;

C. F. Dalziel, on the proposed Sectional Committee on Electric Fences.

Upon recommendation of the standards committee, the board approved a revision, submitted by the Underwriters' Laboratories under American Standards Association proprietary procedure, of American Standard C65, "Power Operated Receiving Appliances," and a revision, presented by the committee on instruments and measurements, of AIEE Standard No. 4, "Measurement of Test Voltages in Dielectric Tests."

In accordance with section 33 of the constitution, the following members of the committee of tellers were approved for appointment by the president:

R. B. Morton, *chairman*, G. C. Barney, M. L. Gardner, E. Joel, Jr., Charles W. Miller, J. F. Moore, N. S. Spatz.

Representatives appointed were:

H. B. Gear to Marston Medal Board of Award, to fill unexpired term, ending August 1, 1944, of Bion J. Arnold, deceased;

L. R. Mapes to Washington Award Commission, for two-year term beginning June 1, 1942, succeeding L. W. W. Morrow, whose term expires at that time.

H. H. Henline was reappointed national secretary of the Institute for the administrative year beginning August 1, 1942, in accordance with section 37 of the constitution.

As a result of a recommendation of the committee on professional training of the Engineers' Council for Professional Development that copies of society publications be sent to libraries of the armed forces of the country, where they can be made available to engineers in the service, the board of directors directed that a notice be published in the July issue of *Electrical Engineering*, inviting Institute members to donate their copies of *Electrical Engineering* for this purpose each month, after they have finished with them, a forwarding address to be furnished to each member volunteering.

Upon recommendation of the joint conference committee of presidents and secretaries of the Founder Societies, the board voted to invite the American Institute of Chemical Engineers to become one of the societies participating in the joint conference committee.

In acceptance of an invitation to the dedication of the Northwestern Technological Institute, at Evanston, Ill., on June 15–16, 1942, T. G. LeClair was appointed by the president, upon authorization by the board, to represent the Institute on this occasion.

Other actions taken included the following:

Minutes of the board of directors' meeting held January 29, 1942, were approved.

Actions of the executive committee on applications were reported and confirmed, as follows: As of March 23, 1942—9 applicants transferred and one elected to the grade of Fellow, 41 applicants elected and 30 transferred to the grade of Member, 182 applicants elected to the grade of Associate, 159 Students enrolled; as of April 10, 1942—3 applicants transferred to the grade of Fellow, 16 applicants transferred to the grade of Member, 508 elected to the grade of Associate, 85 Students enrolled.

Reports were presented and approved of meetings of the board of examiners held February 19, March 19, April 23, and May 21, 1942. Upon recommendation of that board, the following actions were taken: 3 applicants transferred to the grade of Fellow, 14 applicants transferred and 34 elected to the grade of Member, 517 applicants elected to the grade of Associate and one Associate reinstated, 265 Students enrolled.

Monthly disbursements were reported by the finance committee and approved by the board, as follows: $27,196.93 in February, $28,400.41 in March, $33,883.25 in April, and $31,654.16 in May. It was reported that the accounts of the Institute for the fiscal year which ended April 30, 1942, had been audited and the auditors' report was included in the annual report of the board of directors (pages 379–81).

Those present were:

President—David C. Prince, Schenectady, N. Y. *Past Presidents*—F. Malcolm Farmer, New York, N. Y.;

Send EE to the Army!

Institute members may do a service to engineers in the Armed Forces by sending their copies of *Electrical Engineering* to Army and Navy libraries after reading them. For the benefit of technical men in military and naval service, the committee on professional training of the Engineers' Council for Professional Development has suggested to its constituent engineering societies that arrangements be made to place current copies of the engineering journals in all organized libraries serving Army camps and ship and shore stations of the Navy serving technical contingents. Relevant to this suggestion, the Institute's board of directors took action at its May meeting inviting interested AIEE members to participate in the plan, and authorized a procedure to facilitate such participation. Any member who wishes to pass on his copy of *Electrical Engineering* each month should notify National Secretary Henline, who will supply the address of an authorized Army or Navy library serving engineering units of the Armed Forces. Members thus may forward their copies of the magazine with the assurance that they will be helping electrical engineers in the services to keep in touch with developments in the profession.

Future AIEE Meetings

Pacific Coast Convention
Vancouver, B. C., September 9–11, 1942

Winter Convention
New York, N. Y., January 25–29, 1943

R. W. Sorensen, Pasadena, Calif. *Vice-Presidents*—J. L. Hamilton, St. Louis, Mo.; N. S. Hibshman, Bethlehem, Pa.; J. Elmer Housley, Alcoa, Tenn.; Everett S. Lee, Schenectady, N. Y.; C. A. Price, Hamilton, Ont.; A. LeRoy Taylor, Salt Lake City, Utah. *Directors*—T. F. Barton and H. S. Osborne, New York, N. Y.; M. S. Coover, Ames, Iowa; Mark Eldredge, Washington, D. C.; Lester R. Gamble, Spokane, Wash.; T. G. LeClair and L. R. Mapes, Chicago, Ill.; W. B. Morton, Philadelphia, Pa.; R. G. Warner, New Haven, Conn. *National Treasurer*—W. I. Slichter, New York, N. Y. *National Secretary*—H. H. Henline, New York, N. Y.

Contents of June 1942 Supplement

Supplementing the technical papers that have been preprinted from the 1942 volume of AIEE *Transactions* in the monthly *Transactions* sections of *Electrical Engineering* for January through June, a June 1942 "Supplement to *Electrical Engineering*—*Transactions* Section" is being issued. This supplement will contain five technical papers and all discussions of these papers and of those preprinted in the January–June monthly sections. Its publication completes the preprinting of papers and discussions presented at the 1942 winter convention, which was begun in the January 1942 section, in accordance with the provisions of the publication policy adopted at the AIEE summer convention in 1940. The June 1942 supplement will contain a total of 136 pages.

Copies of the supplement will be mailed shortly to those who entered advance orders. Others may obtain copies at 50 cents each ($1 outside United States and its possessions) from the AIEE order department, 33 West 39th Street, New York, N. Y., as long as the limited supply lasts.

Abstracts of three of the papers in the current supplement have already been published in *Electrical Engineering* in advance of the winter convention, in accordance with publication-policy provisions. Abstracts of the two remaining papers follow.

42-46—The Magnetic-Drag Tachometer; *R. G. Ballard.* This paper discusses a magnetic-drag tachometer equipment designed principally for aircraft use. The principle of operation makes possible an indicator which may be read very accurately under extreme conditions of aircraft use and at the same time may be easily adjusted and maintained. Because of the extreme reading accuracy obtainable, low inherent temperature errors and good compensation are essential. A method of obtaining these features is presented.

42-47—The Application of Voltage Regulators to Aircraft Generators; *L. W. Thompson (A'39) and F. E. Crever (A'27).* The use of high-capacity d-c generators on aircraft has required the development of regulators of rapid response, high accuracy, and with features for parallel operation of variable-speed machines. The fundamental requirements of light weight, ability to withstand shock and vibration and to give low radio interference were vital factors considered in the development. A device incorporating these features is described and analyzed. Results of tests on these equipments have shown that regulators with these features are vital to the operation of the electric loads of modern planes, both the military and commercial types. The tests show that the requirements have been met with devices suited to high production methods.

The other papers appearing in the supplement are:

42-22—Impulse and 60-Cycle Characteristics of Driven Grounds—II; *P. L. Bellaschi (F'40), R. E. Armington (Enrolled Student), A. E. Snowden (Enrolled Student).* Abstracted in December 1941 issue, page 600.

42-36—Synthetic or Equivalent Load Curves; *R. E. Hamilton (M'18).* Abstracted in January 1942 issue, page 45.

42-56—Acoustics and the Quiet Train Ride; *William A. Jack.* Abstracted in January 1942 issue, page 44.

Additions to List of Members for Life

Membership for life is granted by the AIEE to members who either have paid annual dues for 35 years, or have reached the age of 70 and have paid dues for 30 years. A list of those who have become members for life during the preceding year is published annually in *Electrical Engineering*. The following are the Institute members who have reached member-for-life status since publication of the last previous list in the July 1941 issue.

E. M. Ashworth
C. D. Backus
H. P. Baker
W. E. Barrows
W. B. Beals
R. Beeuwkes
G. R. Benjamin
A. Berggren
A. R. Bingham
W. T. Bivins
M. O. Bolser
H. L. Bostater
B. J. Bowen
F. E. Bullock
J. L. Burnham
L. H. Burnham
H. L. Caldwell
G. H. Calkins
E. A. Champlin
E. J. Cheney
H. C. Clement
E. H. Colpitts
D. C. Conkling
N. J. Conrad
M. T. Crawford
W. B. Creagmile
M. Creese
S. R. Crosse
J. H. Cunningham
N. H. Daniels
R. S. Daniels
J. C. Davenport
J. C. Davidson
G. Deakin
R. H. Dearborn
C. W. De Forest
A. P. Denton
H. Dingle
D. DuBois
R. W. Eaton
W. H. Evans
D. V. Fennessy
F. C. Finkle
A. C. Finney
D. J. Fleming
H. S. Foley
J. T. Frankenberg
M. Freund
A. J. Fry
N. E. Funk
H. R. Gabay
H. C. Gardett
H. D. Garretson
S. E. Gates
F. W. Gay
J. M. Gaylord
W. S. Gorsuch
S. Haar
A. W. Henshaw
A. S. Hill
A. J. Hixon
W. M. Hoen
W. A. Holland, Jr.
H. L. Hope
R. D. Hope
J. H. Hunt
S. E. Hutton
W. F. Hynes
A. G. Jones
A. S. Kappella
H. A. Kidder
M. King
A. J. Kohler
W. B. Kouwenhoven
J. C. Langdell
J. F. Lewis
E. A. Lof
K. H. Logan
W. V. Lyon
W .S. Maddocks
F. V. Magalhaes
L. A. Magraw
D. M. Mahood
F. I. Manvel
E. J. K. Mason
F. P. McBerty
F. P. McDermott
W. A. Miller
T. O. Moloney
G. H. Moore
F. D. Morgans
F. H. Murphy
P. J. Murphy
C. P. Nachod
F. D. Newbury
L. L. Newman
F. D. Nims
S. I. Oesterreicher
H. W. Osgood
R. D. Parker
F. J. Petura
G. W. Pierce
C. W. Place
A. W. Post
P. H. Powell
M. W. Pullen
J. R. Read
A. B. Reynders
G. I. Rhodes
J. S. Riddile
J. H. Roddey
W. S. Rodman
G. S. Rose
H. S. Rush
L. K. Sager
C. H. Sanderson
J. F. Santa Cecilia
E. B. Schattner
A. Shane
V. W. Shear
F. H. Shepard
R. W. Shoemaker
A. E. Silver
W. M. Skiff
J. H. Smeaton
G. W. Smith
R. W. Smith
W. C. Smith
C. A. Soans
H. A. Stanley
H. W. Starr
L. A. Stenger
M. B. Stewart
A. Still
C. H. Taylor
W. B. Taylor
F. D. Thompson
C. E. Vance
H. B. Vincent
C. O. Von Dannenberg
A. H. Vorum
W. C. Wagner
L. D. Waldron
P. J. Walton
T. D. Waring
G. Y. Watt
J. W. Welsh
P. A. Westburg
W. C. Whiston
M. A. Whiting
V. Wichum
P. F. Williams
S. B. Williams
E. Woodbury
J. B. Woodyatt
W. R. Work
A. G. Wylie
F. E. Wynne
C. W. Young
H. B. Zimmerman

DISTRICT • • • • •

Nine Districts Announce Prize Awards for Papers

District prizes for AIEE papers have been announced by nine Districts. The awards are for papers presented during 1941, except Branch papers, which were presented during the academic year ending June 30, 1941.

District 1

Prizes for best paper and initial paper were awarded to T. A. Rich (A'41) for his paper, "Ampere-Squared-Second Recorder," presented at the North Eastern District meeting, Rochester, N. Y., April 30–May 2, 1941.

District 2

Prize for best paper was awarded to E. W. Boehne (M'37) for his paper, "The Geometry of Arc Interruption," presented at the AIEE winter convention, Philadelphia, Pa., January 27–31, 1941.

Prize for initial paper was awarded to J. D. McCrumm (A'36) for his paper, "An Experimental Investigation of Subharmonic Currents," presented at the same convention.

District 3

Prize for Branch paper was awarded to A. J. Dolan (A'42) for his paper, "The Design and Construction of a Vacuum-Tube Voltmeter for Educational Use," presented at the 15th annual Student Branch convention, Rutgers University, New Brunswick, N. J., April 24, 1941. Honorable mention for Branch paper was given to V. Petrucelly, Jr., for his paper, "An Automatic Intercommunicating System," presented at the same convention.

District 5

Prize for Branch paper was awarded to C. T. Damaske for his paper, "An Analysis of Color and Contrast of Automobile License Plates and Highway Signs," presented at a meeting of the University of Illinois Branch, Urbana, May 1941.

District 6

Prize for Branch paper was awarded to F. H. Slaymaker (A'42) for his paper, "Frequency Response and Efficiency Measurements of a Loud-Speaker," presented at the 14th annual District conference on student activities, Denver, Colorado, April 18–19, 1941.

District 7

Prize for Branch paper was awarded to L. K. Davis

(Enrolled Student) and B. W. Pike (Enrolled Student) for their paper, "Localized Annealing of Rock-Bit Bodies by Sixty-Cycle Induction Heating," presented at the South West District Student Branch convention, University of Missouri, Columbia, April 28–29, 1941.

District 8

Prize for Branch paper was awarded to R. E. Hedges for his paper, "An Electrical Method for Automatic Musical Transposition," presented at a joint meeting of the Los Angeles Section and the University of Southern California Branch, April 8, 1941.

District 9

Prize for Branch paper was awarded to R. W. Retherford for his paper, "The Design and Construction of the Longest Power Span in the Northwest," presented at a joint meeting at the Spokane Section and the University of Idaho Branch, Moscow, Idaho, May 9, 1941.

District 10

Prize for best paper was awarded to A. H. Frampton (M'38) and E. M. Wood (M'25) for their paper "The 220,000-Volt System of the Hydro-Electric Power Commission of Ontario," presented at the AIEE summer convention, Toronto, Ont., June 16–20, 1941.

Prize for initial paper was awarded to H. M. Shockley (A'25) for his paper, "The Selection of Switchgear for Industrial Plants," presented at the Toronto Section meeting, October 24, 1941.

Prize for Branch paper was awarded to C. R. Hoar, H. G. Mah (A'41), and A. M. McQuarrie (A'41) for their paper, "The Predetermination of the Regulation of Salient-Pole Alternators," presented at a meeting of the University of Alberta Branch, Edmonton, November 19, 1940.

BRANCH

Annual Student Conference Held by North Central District

The 15th annual student conference of the AIEE North Central District (6) was held at Colorado State College of Agriculture and Mechanical Arts, Fort Collins, Colo., on April 17–18, 1942. Nine colleges and universities were represented at the conference, which had a registration of 134 students, faculty members, and guests. The program included two technical sessions; a luncheon; a meeting of incoming Branch chairmen, which was addressed by H. W. Bibber (A'21, M'30) chairman of the national committee on Student Branches, and professor of electrical engineering and head of the division of engineering, Union College, Schenectady, N. Y.; a meeting of Branch counselors; a banquet at which Professor Bibber spoke; and a final session at which President D. C. Prince was the speaker and at which awards for student papers were announced.

At the meeting of the Student Branch counselors it was voted to hold the 1943 student conference at the South Dakota State School of Mines, Rapid City, on April 23–24, 1943. Professor E. E. Clark (A'19, M'31) acting head of the electrical engineering department at South Dakota State School of Mines, was appointed chairman of the District committee on student activities and counselor delegate to represent the North Central District at the 1942 summer convention.

At the technical sessions the following student papers were presented:

Parallel Operation of D-C Shunt Motors, **James Bittner, Jack Miller, William Graham,** Colorado State College.

Nomograms, **Milton Crothers,** South Dakota State College.

Antennas for Portable Operation, **Sam C. Phillips,** University of Wyoming.

Impulse Voltage Testing, **Victor Miller,** University of Colorado.

The Feasibility of Electric Brakes for Automobiles, **Eugene H. Bender,** South Dakota School of Mines.

The Operation of Three-Phase Motors from a Single-Phase Supply, **Edward Edison,** University of North Dakota.

The Essentials of Demand and Demand Metering, **James Hellon,** University of Denver.

A Demonstration Oscillograph, **Virgil Matheson,** University of North Dakota.

The District prize for a Branch paper was awarded to Edward Edison. Virgil Matheson received first honorable mention and Victor Miller, second honorable mention

Student Conference Held By Great Lakes District

A conference of Student Branches in the Great Lakes District (5) was held on May 2, 1942, at Northwestern University Technological Institute, Evanston, Ill. In addition to the presentation of student papers, the program included a morning session, with E. W. Kimbark (M'35) acting head of the electrical engineering department of Northwestern Technological Institute, presiding, and Dean O. W. Eshbach and F. G. Seulberger, chairman of the department of industrial relations, speakers; a business meeting; a buffet luncheon; inspection of the laboratories of Northwestern Technological Institute; and a dinner meeting with the Chicago Section, at which President D. C. Prince was the principal speaker and K. V. Glentzer (A'36) chairman of the Chicago Section, toastmaster.

The following were among the student technical papers presented:

Graphical Reproduction by Radio, **Herbert Sandstrom,** Michigan College of Mining and Technology.

A Laboratory for the Construction of Vacuum Tubes, **George Gotschall,** University of Michigan.

Engineering Aspects of Mass Spectrometry, **Joseph F. Hull,** University of Wisconsin.

Hysteresis Loop Tracing by Means of the Cathode-Ray Oscillograph, **R. R. Bush,** Michigan State College.

The Historical, Technical, and Economic Aspects of Communication by Frequency Modulation, **Donald A. Franke,** University of Minnesota.

Design of Involute Reflectors for Fluorescent Lamps, **Joseph A. Kaelin,** University of Illinois.

Transformer Surge Voltages, **Messrs. Hart, Plengey, Ptak,** and **Rebak,** Illinois Institute of Technology.

The Design of a Fluorescent Study Lamp, **Dwight James,** Iowa State College.

Members of the District committee on student activities for 1942–43 were elected at the conference, as follows:

Professor H. O. Warner, University of Detroit, *chairman;* Professor M. M. Cory, Michigan State College; Doctor E. W. Kimbark, Northwestern Technological Institute.

District 2 Branch Convention Held at Princeton

The annual Student Branch convention of the AIEE Middle Eastern District was held April 17, 1942, at Princeton University, Princeton, N. J. The attendance totaled 172, representing 11 colleges and universities. Inspection trips to the plant of the Walker Gordon Dairy Company and the observatory and physics department of Princeton University were features of the program, in addition to the presentation of student papers. Prizes for papers were awarded by a jury consisting of Doctor Ralph E. Beal, RCA Manufacturing Company; H. E. Farrer (A'21), AIEE headquarters; Doctor Morland King, head of the electrical-engineering department, Lafayette College. W. M. Harris, Haverford College, won first prize, a $25 War Bond; G. W. Schroeder, Princeton University, second prize, $5 worth of War Stamps. The program of student technical papers follows:

Console-Type Stage Switchboard at Haverford, **William M. Harris,** Haverford College

The Measurement of Radio-Frequency Power, **Werner Rueggeberg,** The Johns Hopkins University

Correlation of the Earth's Magnetic Field and the Aurora Borealis, **Henry Lawrence Abbott,** Lehigh University

Electrical Installations in the New War Department Building, **Richard B. Schulz,** University of Pennsylvania

Cooking by Electrical Conduction, **George W. Schroeder,** Princeton University

Effect of Initial Conditions on Subharmonic Oscillations, **T. P. Evans, C. F. Spitzer,** Swarthmore College

Ultrasonic Vibrations, **F. E. Morgan,** Drexel Institute of Technology

News Bulletin to Be Issued for District 1 Branches

A news bulletin to be circulated among the Student Branches of the AIEE North Eastern District will be undertaken, as the result of a decision reached at the meeting of Branch chairmen held May 1, 1942, at Schenectady, N. Y., in connection with the student convention at the North Eastern District meeting. Charles L. Seeger, Cornell University Branch, and Gerald Jacobs, Rhode Island State College Branch, will be joint editors of the publication, the first issue of which is scheduled to appear in the fall of 1942. The various Student Branches in the District will be asked to furnish announcements of meetings and news items for inclusion in the bulletin.

SECTION

Chicago Section Sponsors Student-Paper Contest

A technical-paper contest for electrical engineering students at Illinois Institute of Technology and Northwestern University

Technological Institute has been conducted annually for the past three years by the AIEE Chicago Section. The three best papers are selected for oral presentation, on which prizes are based. Judges of this year's presentation, which was held April 30, 1942, were AIEE Director T. G. LeClair (F'40) Commonwealth Edison Company; F. H. Hollister (M'30) Sargent and Lundy, Inc.; W. J. Lempke (M'36) American Telephone and Telegraph Company. The prize-winning papers were:

First prize—"Ultrahigh-Frequency Measurements," by David Ringwalt, Martell Tuntland (Enrolled Students), and Wallace Giedt, all of Northwestern University Technological Institute.

Second prize—"Three-Phase Transmission Line Constants," by Leland Olson, E. H. Schrot, G. W. Staats, H. H. Tom (Enrolled Students), and William Dres, all of Illinois Institute of Technology.

Third prize—"Transformer Inrush Current Phenomena," by R. J. Bosnack, R. K. Dean, R. A. Koehler, J. N. Kunst, and R. W. Wessel (Enrolled Students), all of Illinois Institute of Technology.

Springfield Section Holds Ladies' Night. At a joint meeting with the Engineering Society of Western Massachusetts on May 19, 1942, the Springfield Section held its second annual ladies' night at the Hotel Sheraton, Springfield, Mass., with an approximate attendance of 160 persons. Following a smorgasbord dinner, Charles A. Mitchell, superintendent of schools in Easthampton, Mass., and former principal of the American School in Tokyo, spoke on Japan.

Washington Section Holds Outing

The second annual outing of the AIEE Washington Section was held at Rock Creek Recreational Center, East Leland and Beach Drive, Chevy Chase, Md., on June 13, 1942. Following the afternoon entertainment, which included athletics and a bridge tournament, with prizes for all events, a buffet supper was served.

During the evening the following new Section officers were installed:

G. R. Wilhelm (A'29) general plant engineer, Chesapeake and Potomac Telephone Company, Washington, D. C., *chairman;* A. G. Ennis (M'38) assistant professor of electrical engineering, George Washington University, Washington, D. C., *vice-chairman;* F. S. Black (A'34) engineer, Potomac Electric Power Company, Washington, D. C., *secretary-treasurer;* and W. F. Dietz (A'28) assistant manager, Westinghouse Electric and Manufacturing Company, Washington, D. C., and W. A. Laning (M'38) assistant professor of electrical engineering, University of Maryland, College Park, *members of the executive committee.*

F. M. Defandorf (M'37) physicist, National Bureau of Standards, Washington, D. C., and retiring chairman of the Section, presented the new chairman with a gavel. Mark Eldredge (F'33) specialist consultant for the War Production Board, presented watch charms to the three previous chairmen in recognition of their services. The recipients were F. M. Defandorf; R. W. Prince (M'30) chief engineer, Chesapeake and Potomac Telephone Company; and J. E. O'Brien (M'39) former head of the special problems section, technical standards division, Rural Electrification Administration, now a captain in the United States Marine Corps. As funds become available, it is planned to extend the presentations to other former chairmen. Entertainment during the evening was provided by a quartet from the Potomac Electric Power Company and an amateur magician.

Informal Luncheons Prove Successful at San Francisco. Some 15 years or more ago a small group of members of the San Francisco Section established the practice of meeting informally and without prearrangement at the Engineers Club once a week for luncheon and an informal chat about items currently of interest. It was not long before the "AIEE Table" became a fixture and a tradition in the Engineers Club dining room every Tuesday noon; its popularity was infectious, and the average attendance has grown from the original half-dozen or so to a present average of 40 or 50. There is no program, and the formal arrangements are limited strictly to time, place, food, and sociability. Frequently a really hot impromptu debate develops, and many weighty matters are "settled."

San Francisco Section Holds Past Chairmen's Reunion

Eighteen out of a total of 26 living past chairmen of the San Francisco Section were present for the "Past Chairmen's Night" meeting of the Section March 27. The affair repeated the success that has attended such occasions in other Sections, and a strong sentiment was expressed for making it an annual event. Only three of the past chairmen currently residing within the San Francisco Section area were absent from the meeting. In honor of his position of seniority as the Section's oldest living past chairman (1910–11) S. J. Lisberger was acclaimed as toastmaster.

The roster of attending past chairmen of the Section reads as follows:

S. J. Lisberger (1910–11), J. P. Jollyman (1920–21), W. P. L'Hommedieu (1921–22), J. A. Koontz (1923–24), F. R. George (1924–25), R. C. Powell (1925–26), D. I. Cone (1926–27), B. D. Dexter (1928–29), L. F. Fuller (1929–30), E. A. Crellin (1931–32), E. F. Maryatt (1932–33), W. C. Smith (1933–34), A. M. Bohnert (1934–35), E. M. Wright (1935–36), H. S. Lane (1936–37), F. S. Benson (1938–39), C. A. Andrews (1939–40), C. V. Fowler (1940–41).

In addition to these, honorary recognition also was extended to A. G. Jones, who for 19 years (1910–29) served the Section as its secretary.

Other past chairmen of the Section include:

G. O. Squier* (1904–05), C. L. Cory* (1905–07), A. M. Hunt (1907–08), C. W. Burkett (1908–09), G. R. Murphy* (1909–10), S. B. Charters* (1911–12), H. W. Crozier* (1912–13), A. H. Griswold (1913–14), C. J. Wilson (1914–15), A. H. Babcock* (1915–16), J. E. Woodbridge* (1916–17), L. R. Jorgensen* (1917–18), J. C. Clark (1918–19), W. G. Vincent (1919–20), H. H. Henline (1922–23), W. L. Winter (1927–28), P. B. Garrett (1930–31), R. O. Brosemer (1937–38).

* Deceased.

ABSTRACTS • • •

TECHNICAL PAPERS reviewed in this section were presented at the AIEE summer convention, Chicago, Ill., June 22–26, 1942. Copies may be obtained by mail from the AIEE order department, 33 West 39th Street, New York, N. Y., at prices indicated with the abstract; or at five cents less per copy if purchased at AIEE headquarters.

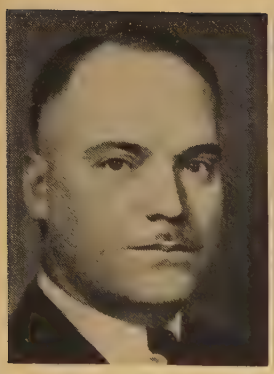
Communication

42-132—Poles and Pole Treatment; *Reginald H. Colley. 20 cents.* This paper is a digest of some of the more important pole problems. Analyses of pole use are correlated with information on the natural supply of raw material in the forest. Recent data on the preservative treatment and on the breaking strength of southern pine poles are included. There are sections on preparing poles for treatment, on new preservatives, and on the relation of moisture content to electrical resistance. Stress is laid on the advantages of standard framing and treating practice and on the virtual necessity for a broader use of available pole species, particularly in sizes required for joint use in power and communication lines.

42-133—The Combination of Probability Curves in Engineering; *Roger I. Wilkinson (A'35). 30 cents.* The elementary principles are presented by which an engineer can determine the characteristics of the probability distribution resulting from the joint action of two or more primary variates. Discrete and continuous variates of both the mutually exclusive and independent types are considered. Their exact combination is studied, and approximate moment and other methods are given for obtaining solutions when less comprehensive results are needed. For the case of independent variates the common operations of addition, subtraction, multiplication, and division are covered in some detail. Several examples drawn from various phases of engineering illustrate the principles and the kind of results obtainable.

PERSONAL • • • •

Carthrae Merrette Laffoon (A'24, M'39) engineering manager, a-c generator engineering department, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., was elected a director of the Institute to fill the unexpired term, ending July 31, 1943, of R. E. Hellmund (F'13) who died on May 16, 1942 (*EE, June '42, pages 320, 329*). Mr. Laffoon was born at Coldwater, Kans., on August 14, 1888, and received from the University of Missouri the degrees of electrical engineer in 1914 and master of arts in 1915. During 1914–15 he was research assistant at the engineering experiment station at the University of Missouri, Columbia, and during 1915–16 he did construction engineering for Black and Veatch, consulting engineers, Kansas City, Mo. He has been with the Westing-



C. M. Laffoon



Karsh photo

A. G. L. McNaughton



Edith Clarke



S. B. Crary



J. H. Hagenguth

house Electric and Manufacturing Company since 1916. He worked as a design engineer on frequency changers and turbine generators until 1925, when he became section engineer in charge of large-capacity turbine generators. From 1930 to 1937 he was section engineer in charge of turbine generators, water-wheel generators, frequency converters, and synchronous condensers. In 1937 he became engineering manager of the a-c generator engineering department. He has been a member of the AIEE committee on electrical machinery since 1934 (chairman 1938–40) and was a member of the technical program committee 1938–40. He is also a member of Sigma Xi and Tau Beta Pi.

Andrew George Latta McNaughton (A'11) lieutenant general and commander in chief, Canadian Active Service Force, recently was elected an Honorary Member of the Institute "in view of his unusual record as an engineer, administrator, research director, and soldier." He is on leave of absence from his post as president of the National Research Council, Ottawa, Ont. He was born on February 25, 1887, at Moosomin, Sask., and received from McGill University the degrees of bachelor of science in 1910, master of science in 1912, and an honorary degree of doctor of laws in 1920 as well as an honorary degree of doctor of civil law from Bishop's University in 1937. He was a member of the teaching staff of McGill University from 1912 to 1914, when he entered private engineering practice. He joined the militia in 1909 and by 1913 had risen to the rank of major, commanding the third (Montreal) field battery. He began active military service at the outbreak of World War I, and in 1916 was made a lieutenant colonel. In 1917 he was appointed counter battery staff officer and in 1918 became brigadier general. Upon his return to Canada in 1919, he was made a member of the committee for the reorganization of the Canadian military forces. He became director of military training in 1920 and deputy chief of the general staff in 1923. When the Imperial Defence College was instituted in 1927 he was selected as Canadian representative. When he returned to Canada, he was appointed district officer, commanding military district 11 (British Columbia) in 1928, and in 1929 became chief of the general staff, highest Canadian military post, and major general. In 1935 he became president of the National Research Council and in that position actively promoted the application of science to industry. He played a large part in the design of the high-voltage laboratories of the Research Council at Ottawa and collaborated in the development of the cathode-ray direction-finder. In 1939 he was appointed by the Canadian government as technical adviser to a delegation of Canadian manufacturers to Great Britain to investigate the possibilities of producing munitions in Canadian plants. In 1939 he became inspector general of the first Canadian division of the Canadian Active Service Force and in 1940 was appointed lieutenant general and placed in command of a British army corps which included Canadian forces in England. He served as adviser to the Canadian delegation at the conference for the limitation of armaments at Geneva, Switzerland, in 1932, and was a member of the committee of trans-Atlantic air service at the imperial economic conference, Ottawa, in 1932. He was chairman of the interdepartmental committee on the trans-Canada airway, 1933–35, and since 1933 has been chairman of the National Research Council Associate committee on survey research. He is also a member of the Institution of Electrical Engineers (England) and the Engineering Institute of Canada. He is the author of a number of technical articles.

Edith Clarke (A'23, M'33) central-station department, General Electric Company, Schenectady, N. Y., co-author with S. B. Crary (A'31, M'37) of the paper, "Stability Limitations of Long-Distance A-C Power-Transmission Systems," has received the 1941 AIEE national prize award for best paper in engineering practice. She was born February 10, 1888, in Howard County, Md., and received the degree of bachelor of arts from Vassar College in 1908 and that of master of science in electrical engineering from Massachusetts Institute of Technology in 1919. After four years spent in teaching and study, she became computer for the research engineer of the American Telephone and Telegraph Company, New York, N. Y., in 1912 and from 1915 to 1919 was in charge of transmission calculations. In 1919 she joined the General Electric Company, Schenectady, N. Y., and was placed in charge of calculations. During 1921–22 she was professor of physics at Constantinople Women's College, Turkey (now Istanbul College). In 1922 she returned to the General Electric Company to work on power-generation and transmission problems in the central-station department. In 1930 she was placed in charge of a group of engineers working on generation and transmission problems. She was awarded the AIEE 1932 North Eastern District prize for best paper. She is also a member of Phi Beta Kappa. She holds patents on calculating and electrical power transmission devices and is the author or co-author of a number of technical articles.

S. B. Crary (A'31, M'37) central-station engineering department, General Electric Company, Schenectady, N. Y., co-author with Edith Clarke (A'32, M'33) of the paper, "Stability Limitations of Long-Distance A-C Power-Transmission Systems," has received the 1941 AIEE national prize award for best paper in engineering practice. He was born on May 17, 1905, at Marquette, Mich., and received the degree of bachelor of science from Michigan State College in 1927. From 1925 to 1927 he was engaged in work on plant records and tests with the City of Lansing (Mich.) Board of Water and Electric Light and Power Commission. In 1927 he joined the test course of the General Electric Company, Schenectady, N. Y., and in 1928 he was transferred to the transformer engineering department at Fort Wayne, Ind. In 1929 he returned to enter the company's central-station department. As co-author of a paper with M. L. Waring (A'29, M'36) he received the AIEE 1932 North Eastern District prize for initial paper, and as co-author with D. R. Shoults (A'35) he received honorable mention in the 1936 AIEE national prize award for best paper in theory and research.

J. H. Hagenguth (A'28) electrical engineer, high-voltage engineering laboratory, General Electric Company, Pittsfield, Mass., has received the 1941 AIEE national prize award for best paper in theory and research for his paper, "Volt-Time Areas of Impulse Spark-Over." He was born December 23,

1901, at Greipwald, Germany, and was graduated in 1925 as diplomingenieur from the Technische Hochschule, Munich, Germany. After a year spent in conducting a power survey with the Kraftwerke Westsachsen, he entered the transformer testing department of the General Electric Company, Pittsfield, Mass., in 1926. From 1927 to 1933 he was in the power transformer engineering department and in 1933 joined the staff of the high-voltage engineering laboratory of which he was later placed in charge. He received honorable mention in the 1937 AIEE national prize award for best paper in theory and research.

M. J. DeLerno (Enrolled Student) coauthor with R. T. Basnett (A'42) of the paper "An Electronic Circuit for Determining Power-Angle Oscillations," has received the 1941 AIEE national prize award for Branch paper. He was born at New Orleans, La., on January 8, 1922, and was graduated in 1941 with the degree of bachelor of engineering in electrical engineering from Tulane University of Louisiana, where he served as vice-chairman, 1939–40, and secretary treasurer of the AIEE Student Branch, 1940–41. In 1941 he entered the General Electric test course. Since September 1941 he has been studying for the degree of master of electrical engineering at Rensselaer Polytechnic Institute and working at the General Electric Company, Schenectady, N. Y., where he has been recently transferred to the industrial engineering department. He is also a member of Tau Beta Pi.

R. T. Basnett (A'42) control engineer, control engineering department, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., co-author with M. J. DeLerno (Enrolled Student) of the paper, "An Electronic Circuit for Determining Power-Angle Oscillations," has received the 1941 AIEE national prize award for Branch paper. He was born November 29, 1919, at Liverpool, England, and in 1941 was graduated with the degree of bachelor of engineering in electrical engineering from Tulane University of Louisiana. After a short time as student engineer at the Mansfield, Ohio, works of the Westinghouse Electric company, he was transferred to the company's East Pittsburgh plant as student engineer in the control engineering department. Recently he was appointed control engineer in that department.

G. A. Matthews (A'40) inspection and equipment engineer at the Detroit (Mich.) Edison Company, has received the 1941 AIEE national prize award for initial paper for his paper "Power Arc-Over on Overhead Distribution Lines and Newly Developed Equipment for Protection Against Conductor Burndown From That Cause." He was born at Clinton, Mass., on December 4, 1885. He was employed by the Connecticut Railway and Lighting Company from 1902 to 1914, when he joined the Western Local and Mining Company. He has been with the Detroit Edison Company continuously since 1916.

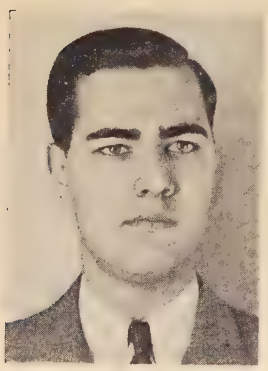
J. G. Trump (A'31) associate professor of electrical engineering, Massachusetts Institute of Technology, Cambridge, coauthor with James Andrias (A'41) of the paper, "High-Voltage D-C Flashover of Solid Insulators in Compressed Nitrogen," has received honorable mention in the 1941 AIEE national prize award for best paper in theory and research. He received the degrees of electrical engineer from Brooklyn Polytechnic Institute in 1929, master of arts in physics from Columbia University in 1931, and bachelor of science in electrical engineering from Massachusetts Institute of Technology in 1933. In 1929 he was employed by the General Electric Company, Pittsfield, Mass., as transformer designer and from 1929 to 1931 he was also instructor in electrical engineering at Brooklyn (N. Y.) Polytechnic Institute. Since 1940 he has been a member of the technical aid division of the national defense research committee. In 1941 he became an associate professor at Massachusetts Institute of Technology, where he has been engaged in research work and development of high-voltage electrostatic generators for the production of X rays and cathode rays for medical use.

M. E. Strieby (M'22, F'41) transmission engineer, long lines department, American Telephone and Telegraph Company, New York, N. Y., co-author with J. F. Wentz (A'24) of the paper, "Television Transmission Over Wire Lines," has received honorable mention in the 1941 AIEE national prize award for best paper in engineering practice. He received the degrees of bachelor of arts from Colorado College in 1914, bachelor of science from Harvard University in 1916, and bachelor of science in electrical engineering from Massachusetts Institute of Technology in 1916. He was employed by the engineering department of the New York Telephone Company 1916–17, and after a period of military service (1917–19) he entered the American Telephone and Telegraph Company as an engineer in the development and research department. From 1929 to 1940 he was transmission systems research engineer with the Bell Telephone Laboratories and in 1940 he joined the long lines department of the American Telephone and Telegraph Company.

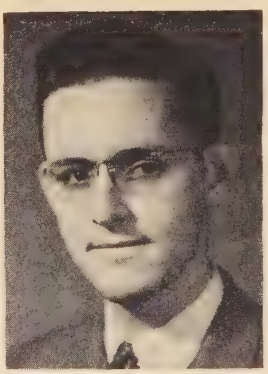
J. F. Wentz (A'24) high-frequency transmission engineer, systems development department, Bell Telephone Laboratories, Inc., New York, N. Y., co-author with M. E. Strieby (M'22, F'41) of the paper "Television Transmission Over Wire Lines," has received honorable mention in the 1941 AIEE national prize award for best paper in engineering practice. He received the degrees of electrical engineer from Lehigh University in 1917 and master of arts from Columbia University in 1923. After an interval of military service (1917–19) he entered the engineering department of the Western Electric Company and in 1924 transferred to the research department of the Bell Telephone Laboratories. In 1930 he was placed in charge of coaxial cable design and in 1940 he was appointed high-frequency transmission engineer in charge of coaxial systems for telephone and television.

L. F. Kennedy (A'37, M'39) relay application engineer, General Electric Company, Schenectady, N. Y., co-author with A. T. Sinks (A'36) of the paper, "New Current Transformer for Bus Differential Protection," has received honorable mention in the 1941 AIEE national prize award for best paper in engineering practice. He was graduated from Rensselaer Polytechnic Institute with the degree of electrical engineer in 1922 and in that year joined the General Electric Company to do test work. He was transferred to the switchgear engineering department in 1923 and from 1928 to 1939 he was in charge of relay development. In 1939 he entered the central-station engineering department as application engineer.

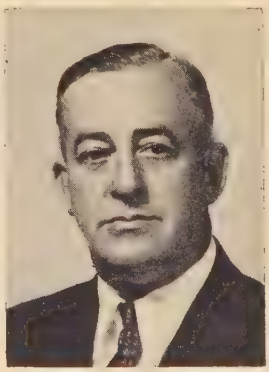
A. T. Sinks (A'36) designing engineer, instrument transformer engineering department, General Electric Company, Lynn, Mass., co-author with L. F. Kennedy (A'37, M'39) of the paper "New Current Transformer for Bus Differential Protection," has received honorable mention in



M. J. DeLerno



R. T. Basnett



G. A. Matthews

the 1941 AIEE national prize award for best paper in engineering practice. He was graduated from Yale University in 1929 with the degree of bachelor of science in electrical engineering and in that year entered the test course of the General Electric Company. In 1930 he was assigned to work on instrument transformer design, and in 1935 was placed in charge of the design and development of dry-type instrument transformers at the company's plant in Lynn, Mass., where he has been continuously since that time.

James Andrias (A'41) assistant engineer, naval ordnance laboratory, United States Navy Yard, Washington, D. C., co-author with J. G. Trump (A'31) of the paper, "High-Voltage D-C Flashover of Solid Insulators in Compressed Nitrogen," has received honorable mention in the 1941 AIEE national prize award for best paper in theory and research. He received from Massachusetts Institute of Technology the degrees of bachelor of science in electrical engineering in 1939 and master of science in electrical engineering in 1940. In 1940 he entered Stone and Webster Engineering Corporation, Boston, Mass., as an electrical designer, and since 1940 he has been associated with the naval ordnance laboratory.

T. R. Tate (M'24, F'35) has resigned as director of the national defense power staff and chief of the bureau of electrical engineering, Federal Power Commission, Washington, D. C., to become consulting engineer with the firm of Charles T. Main, Inc., Boston, Mass., serving as the company's representative in Washington, D. C. He joined the Federal Power Commission in 1934 as director of the national power survey and from 1936 to 1938 was chief of the commission's division of power resources and requirements. In 1938 he became chief of the division of gas and electric resources. He was made chief of the division of electric resources and director of the national defense power staff in 1940.

J. V. Alfriend, Jr. (A'33, M'41) senior engineer, bureau of electrical engineering, Federal Power Commission, Washington, D. C., has become consultant on industrial and power problems related to plant locations with the National Resources Planning Board. He joined the Federal Power Commission in 1934 as associate engineer and later was made engineer. In that capacity he made surveys of power requirements for industrial establishments and during 1941 he was engaged in the analysis of the effect of the defense program on electric loads of major utility systems.

J. P. Clayton (F'36) chief system officer, Commonwealth Edison Company, Chicago Ill., recently received the honorary degree of doctor of engineering from Tulane University of Louisiana. He received the degree of bachelor of engineering from that institution in 1909 and that of mechanical engineer from the University of Illinois in 1911. He has been with the Commonwealth Edison Company since 1932.

OBITUARY • • • •

James Gilbert White (A'89, M'00) chairman, J. G. White and Company, New York, N. Y., died June 2, 1942. Born August 29, 1861, at Milroy, Pa., he received from Pennsylvania State College the degrees of bachelor of arts in 1882 and master of arts in 1884, and doctor of philosophy from Cornell University in 1885. He was instructor of physics at the University of Nebraska, Lincoln, from 1895 to 1887, when he established the Western Engineering Company at Lincoln, Nebr., and became its president. In 1890 he sold the Western Engineering Company to the Edison United Manufacturing Company and was employed by that company as general United States agent for street railway construction. In that year, after the formation of the Edison General Electric Company, he established a contract engineering business in New York, N. Y., under the firm name of J. G. White and Company and became its president. In 1900 he formed the J. G. White Company, Ltd., London, England; in 1905 the Canadian White Company, Ltd., Montreal, P. Q.; and in 1913 the J. G. White Engineering Corporation, New York, N. Y., as an affiliate of the J. G. White Company. He was also associated with several other engineering firms as president or director. As a contracting engineer, he was active in the design and installation of a number of electric railways, among them the Buffalo–Niagara Falls Electric Railway, as well as power plants, bridges, and buildings throughout the United States and foreign countries. He served as a vice-president of the Institute, 1907–09, and a manager, 1904–07, and was a member of the Edison Medal committee, 1909–14. He was also a member of the American Society of Civil Engineers.

L. A. S. Wood (M'24) chief lighting engineer, Westinghouse Electric and Manufacturing Company, Cleveland, Ohio, died on May 5, 1942. He was born on August 15, 1874, at London, England. After studying with a tutor until 1883, he attended City of London School and the University of London. In 1895 he joined the Edison and Swan United Electric Light Company, Ltd., London, England and from 1897 to 1901 he was manager of the company's London showrooms. From 1901 to 1903 he was manager of the London office of Gent and Company. He carried on an independent business, specializing in illumination, from 1903 to 1906, when he became special representative in Europe for the Union Electric Company, London, England. In 1911, he joined the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., as an illumination specialist. From 1915 to 1920 he served as district sales manager for the George Cutter Company, South Bend, Ind., and when that company was absorbed by the Westinghouse company in 1920, he was appointed manager of the illuminating section. In 1930 he was transferred to Cleveland as sales manager, in 1935 was made chief lighting engineer of the lighting division with headquarters in New York, N. Y., and in 1936 returned to Cleveland in that capacity. He had an active part in laying out street lighting systems in a number of cities in the United States and Europe and served as a lighting consultant for the Chicago (Ill.) Exposition and the Great Lakes Exposition. He was a past president of the Illuminating Engineering Society.

William Edwin Freeman (A'11, M'27) professor of electrical engineering and assistant dean of engineering, University of Kentucky, Lexington, died May 21, 1942. He was born at Lexington, Ky., on September 25, 1880, and received from Transylvania College the degree of bachelor of arts in 1901, and from the University of Kentucky the degrees of bachelor of mechanical engineering in 1904 and electrical engineer in 1912. In 1904 he entered the engineering department of the Western Electric Company. In 1911 he was appointed head of the department of electrical engineering at the University of Kentucky. During 1920–21 he served as supervisor of commercial training with the Westinghouse Electric and Manufacturing Company, in 1921 returning to the University of Kentucky as head of the department of electrical engineering and acting dean of the college of engineering. In 1922 he was appointed assistant dean of the college of engineering, a position he held continuously since that time, except for a year (1934) as acting dean. He served as an AIEE vice-president, 1931–33, had been a member of the committee on Student Branches and the committee on education. He was counselor of the AIEE Student Branch at the University of Kentucky 1930–32 and 1935–36. He was also a member of the Society for the Promotion of Engineering Education, and Tau Beta Pi.

Daniel Edgar Manson (A'07, M'28) retired engineer, Boston, Mass., died on April 30, 1942. He was born at New Haven, Conn., on October 13, 1870 and was graduated from Yale University in 1892 with the degree of bachelor of arts. He was employed by the Thomson Houston Electric Company from 1892 to 1893, when he joined the Dennison Electrical Engineering Company, New Haven, Conn. He was secretary-treasurer of the Connecticut Electric Company, New Haven, Conn., from 1895 to 1897 and in that year was employed by the Westinghouse Electric and Manufacturing Company as salesman of electrical apparatus. From 1905 to 1909 he was manager of the company's Boston office. He was made vice-president of the Malden (Mass.) Electric Company, Malden and Melrose (Mass.) Gas Light Company,

Suburban Gas and Electric Company, Revere, Mass., Haverhill (Mass.) Electric Company, Fitchburg (Mass.) Gas and Electric Company, and Springfield (Mass.) Gas Light Company in 1909. In 1912 he became vice-president of the Charles H. Tenny and Company. He also served as president or vice-president of other utility companies in New Hampshire, New York, New Jersey, and Pennsylvania.

Eustace William Ackland (A'05, M'20) managing director, National Electrical and Engineering Company, Ltd., Wellington, New Zealand, died March 28, 1942. He was born at Christchurch, New Zealand, on October 10, 1874, and studied at the Technical College, Sydney, Australia. In 1890 he was employed by Woodhouse and Rawson, Sydney, to do electrical work and in 1894 he joined the Silvertown Telegraph Works Company, Ltd., as engineer in charge of electrical work. In 1899 he became engineer in charge of outside electrical contracts with Edge and Edge, Sydney, and after a year as acting electrical engineer with the Perth Electric Tramways, Ltd., returned to Edge and Edge in 1901 as engineer in charge of cable laying. He became electrical engineer with J. G. White and Company, Auckland, New Zealand, in 1902, in 1903 he was appointed power superintendent, Auckland Electric Tramways, and in 1904 was made assistant engineer with Noyes Brothers, at Dunedin, New Zealand. In 1906 he established the National Electrical and Engineering Company, Ltd., and became its managing director. Shortly after, he was appointed New Zealand agent for the General Electric Company and the British Thomson-Houston Company, Ltd.

Patrick Kelly (A'19) managing director, Edison Swan Electric Company, Ltd., London, England, died April 5, 1942. He was born June 25, 1888, at Ajmere, India, and attended Pratt Institute and St. Joseph's College. In 1907 he was employed by Marshall Sons and Company, Ltd., Bombay, India, and after a period with the Great Indian Peninsula Railway, he joined the F. C. Osler Company, Ltd., Bombay, India, in 1909 to work on light and power installations. From 1912 to 1914 he was engaged in hydroelectric installation for the Amir of Afghanistan, at Kabul, Afghanistan. After working for a short time on power-house construction for the General Electric Company, New Haven, Conn., he spent a year studying at Pratt Institute, Brooklyn, N. Y., 1914–15, returning to the General Electric Company in 1915 as a salesman, and remaining until 1919, except for an interval of military service. In 1920 he was employed by the British Thomson-Houston Company, Ltd., as manager of the Bombay office and in 1923 he joined the Schenectady office of the International General Electric Company. After serving in the London and Paris offices of that company, he was appointed head of merchandising sales, British Thomson-Houston Company, London, England. In 1928 he became managing director of the Edison Swan company.

William Hill Sasscer (A'28, M'40) electrical and mechanical department, Pennsylvania Coal Company, Scranton, died on April 28, 1942. He was born May 4, 1900, at Upper Marlboro, Md., and received the degree of bachelor of science in electrical engineering from Virginia Polytechnic Institute in 1922. In that year he joined the turbine drafting department of the General Electric Company, Schenectady, N. Y., in 1923 he was transferred to the testing department, and in 1924 he entered the industrial sales department. He did motor sales work with the General Electric Company in Philadelphia, Pa., from 1925 to 1927, when he joined the power department of the Philadelphia and Reading Coal and Iron Company, Pottsville, Pa. He was employed by the Pennsylvania Coal Company in 1929 to make a survey of d-c power systems in mines and the following year was transferred to the electrical and mechanical department.

Edward W. Kearns (A'24) central district manager, General Cable Corporation, Chicago, Ill., died on February 18, 1942. He was born on August 3, 1884. In 1899 he joined the Electric Supply Company, Chicago, Ill., and in 1901 he was employed by the Manhattan Electric Supply Company, Chicago, Ill. From 1903 to 1913 he was sales engineer for the Monarch Electric and Wire Company, Chicago, Ill., and from 1913 to 1918 he was sales manager. After service with the United States Army signal corps at Washington, D. C., he became district manager of the Habirshaw Electric Cable Company, New York, N. Y., with headquarters in Chicago, Ill. He was later central district manager for the Safety Cable Company, Chicago, Ill., and in 1930 he became central district manager for the General Cable Corporation.

Eugene William Sanderson (A'10) power plant engineer, New York Telephone Company, Brooklyn, died in March 1942. Born November 21, 1886, at Aurora, S. Dak., he received the degree of bachelor of science from South Dakota State College in 1906. He entered the test course of the General Electric Company, Schenectady, N. Y., in 1907 and in 1908 joined the company's testing department at Pittsfield, Mass., returning to the testing department at Schenectady the same year. After a short time with the Electrical Testing Laboratories, New York, N. Y., he joined the Western Electric Company in 1911. In 1913 he was employed by the New York Telephone Company and was engaged in power plant engineering until 1927, when he was appointed engineer in charge of power plants for the Long Island area.

John Palmer (A'13) district engineer, Canadian Westinghouse Company, Ltd., Montreal, P. Q., died April 20, 1942. Born June 20, 1881, at London, England, he received the degree of bachelor of science in electrical engineering from London University. He was employed as an engineering apprentice with Johnson and Phillips, electrical contractors, London, England, and as chief operator at the power plant of the Southampton (England) Corporation, before going to Canada in 1910. He joined the engineering department of the Canadian Westinghouse Company in 1911 and the following year was transferred to the service department. After two years as a construction engineer, he served until 1920 as the company's district engineer in Calgary, Alberta, except for an interval of military service. In 1920 he was appointed district engineer with headquarters in Montreal.

John W. Andree (M'26) production engineer, Southern California Edison Company, Ltd., Los Angeles, died on April 7, 1942. He was born November 1, 1879, at Cologne, Germany, and was graduated from the University of Illinois in 1907 with the degree of bachelor of science. During 1907 he did electrical construction work for the Bion J. Arnold Company, Chicago, Ill., and after a short time as substation operator with the Commonwealth Edison Company, Chicago, Ill., he taught engineering at DePaul University (1908–10), Chicago, Ill. In 1910 he joined the Southern California Edison Company as production engineer.

Charles William Townsend (A'41) assistant designer, engineering department, Central New York Power Corporation, Syracuse, N. Y., died on May 28, 1942. He was born July 29, 1907, at Waterville, N. Y., and received the degree of bachelor of science in electrical engineering from Clarkson College of Technology in 1932. In 1933 he became instructor of mathematics at the Rensselaer Falls (N. Y.) High School and in 1938 he joined the Central New York Power Corporation as draftsman. He was transferred to the engineering department in 1940.

James Andrews Atwood (A'16) electrical construction engineer, Dayton, Ohio, died January 7, 1942. He was born at Burlington, Vt., on June 17, 1882. From 1901 to 1906 he was employed in the testing department of the Hobart Electric and Manufacturing Company and after working with the Ditto American Fixture and Manufacturing Company, he became engineer and superintendent for the Charles I. Tyson Company, Dayton, Ohio. Since 1912 he had maintained an electrical contracting and consulting practice.

MEMBERSHIP ••

Recommended for Transfer

The board of examiners, at its meeting on June 18, 1942, recommended the following members for transfer to the grade of membership indicated. Any ob-

jections to these transfers should be filed at once with the national secretary.

To Grade of Fellow

Dibner, Bern, executive vice-president, Burndy Engineering Company Inc., New York, N. Y.
Holben, W. P., distribution engineer, Duquesne Light Company, Pittsburgh, Pa.
Jeffries, Zay, technical director, lamp department, General Electric Company, Cleveland, Ohio.
McPhail, H. F., assistant chief electrical engineer, United States Bureau of Reclamation, Denver, Colo.

4 to grade of Fellow

To Grade of Member

Birge, K. R., electrical engineer, City of Pasadena Municipal Light Department, Pasadena, Calif.
Bishop, G. E., electrical superintendent, Coast Counties Gas and Electric Company, Santa Cruz, Calif.
Burrell, R. W., assistant engineer, Consolidated Edison Company of New York, Inc., New York, N. Y.
Conklin, W. A., engineer, Commonwealth and Southern Corporation, Jackson, Mich.
Draper, L. L., protective relay designer, Bureau of Light and Power, Los Angeles, Calif.
Ettinger, V. P., transmission and protection engineer, Southwestern Bell Telephone Company, St. Louis, Mo.
Farnham, S. B., engineer, General Electric Company, Schenectady, N. Y.
Gidlund, H. F., electrical engineer, Public Service Company, Denver, Colo.
Harrison, W. P., assistant distribution engineer, Oklahoma Gas and Electric Company, Oklahoma City.
Hedrich, W. A., instructor in electrical engineering, Michigan State College, East Lansing.
Heffernan, F. J., electrical specifier, Otis Elevator Company, Yonkers, N. Y.
Hoard, G. L., professor of electrical engineering, University of Washington, Seattle.
Hood, H. T., commercial engineer, General Electric Company, Portland, Oreg.
Johnson, W. C., assistant professor of electrical engineering, Princeton University, Princeton, N. J.
Lamson, J. V., electrical engineer, Bonneville Power Administration, Portland, Oreg.
Lewis, M. G., electrical engineer, Austin Willmott Earl, consulting engineer, San Francisco, Calif.
Longley, F. R., electrical engineer, Western Massachusetts Companies, Springfield, Mass.
Mathewson, H. G., building and equipment engineer, Southwestern Bell Telephone Company, Dallas, Tex.
Matthews, G. A., equipment and inspection engineer, Detroit Edison Company, Detroit, Mich.
McKinley, W. W., electrical engineer, Commonwealth and Southern Corporation, Jackson, Mich.
McNeill, H. E., associate engineer, Bonneville Power Administration, Portland, Oreg.
Morgan, W. A., assistant engineer, United States Bureau of Reclamation, Denver, Colo.
Morris, W. D., associate professor of electrical engineering, Louisiana State University, Baton Rouge.
Pettibone, G. H., section head, General Electric Company, Schenectady, N. Y.
Pinchert, W. F., electrical engineer, Office of the United States District engineer, Fort Sam Houston, Tex.
Rehagen, E. S., application engineer, Westinghouse Electric and Manufacturing Company, St. Louis, Mo.
Roters, H. C., director of research, Fairchild Aviation Corporation, Jamaica, N. Y.
Samson, J. J., supervising electrical equipment engineer, Commonwealth Edison Company, Chicago, Ill.
Seaman, J. L., production, schedule, and office operation engineer, Commonwealth and Southern Corporation, Jackson, Mich.
Shaw, F. W., electrical engineer, Kansas City Power and Light Company, Kansas City, Mo.
Shoults, D. R., application engineer, General Electric Company, Schenectady, N. Y.
Sinks, A. T., designing engineer, General Electric Company, Lynn, Mass.
Soliday, H., electrical engineer, The Panama Canal, Diablo Heights, C. Z.
Spatz, N. S., engineer, Public Service Electric and Gas Company, Newark, N. J.
Staacke, H. F., general commercial superintendent, Houston Lighting and Power Company, Houston, Tex.
Stelzer, J. G., engineer, Commonwealth and Southern Corporation, Jackson, Mich.
Treadway, W. H., engineer, Rural Electrification Administration, St. Louis, Mo.

37 to grade of Member

Applications for Election

Applications have been received at headquarters from the following candidates for election to membership in the Institute. Names of applicants in the United States and Canada are arranged by geographical District. If the applicant has applied for direct admission to a grade higher than Associate, the grade follows immediately after the name. Any member objecting to the election of any of these candidates should so inform the national secretary before July 31, 1942, or September 30, 1942, if the applicant resides outside of the United States or Canada.

United States and Canada

1. North Eastern

Blake, G. R., 8 Eddy Street, Waltham, Mass.
Jordan, J. P., General Electric Company, Schenectady, N. Y.
Murphy, T. H., American Locomotive Company, Schenectady, N. Y.
Palmer, H. L., General Electric Company, Schenectady, N. Y.
Saxon, C. B. (Member re-election), American Locomotive Company, Schenectady, N. Y.
Schutz, H. (Member), Thayer School of Engineering, Dartmouth College, Hanover, N. H.
Smith, G. J. (Associate re-election), Eastman Kodak Company, Rochester, N. Y.
Weed, L. J. (Member), Boston Edison Company, Boston, Mass.

2. Middle Eastern

Adams, W. R. F., General Cable Corporation, Washington, D. C.
Bockenek, D. M. (Associate re-election), War Department, Corps of Engineers, Washington, D. C.
Brady, P. B., United States Navy Yard, Philadelphia, Pa.
Dans, M. W. (Associate re-election), Reconstruction Finance Corporation, Washington, D. C.
Dignan, R. C., Cleveland Electric Illuminating Company, Cleveland, Ohio.
Eskin, H., Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.
Ficchi, R. F., United States Navy Yard, Philadelphia, Pa.
Gordon, K. H. (Associate re-election), Pennsylvania Railroad, Philadelphia, Pa.
Hadley, J. L. (Member), Peerless Electric Company, Warren, Ohio.
Harlow, W. G., General Electric Company, Philadelphia, Pa.
Hatchwell, J. A., United States Navy Yard, Philadelphia, Pa.
Hengstler, J. J., War Department, Corps of Engineers, Washington, D. C.
Hunter, W. P., General Electric Company, Philadelphia, Pa.
Kelly, J. A., General Electric Company, Philadelphia, Pa.
Lawton, H. J., Westinghouse Electric and Manufacturing Company, Sharon, Pa.
Lilie, J. P., Cleveland Electric Illuminating Company, Cleveland, Ohio.
Morris, J. C., Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.
Robinson, W. P., Jr., Whitman, Requardt and Smith, Edgewood Arsenal, Md.
Rustebakke, H. M., Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.
Smith, W. L., New York Shipbuilding Corporation, Camden, N. J.
Steudel, E. M., Allied Chemical and Dye, Philadelphia, Pa.
Syracopoulos, P. C., Goodyear Tire and Rubber Company, Akron, Ohio.
Witsberger, C. J., Follansbee Steel Corporation, Follansbee, W. Va.

3. New York City

Boyer, K., Bell Telephone Laboratories, Inc., Whippany, N. J.
Brown, Q. T., Western Electric Company, Kearney, N. J.
Miller, O. G. (Associate re-election), Rome Cable Corp., New York, N. Y.
Quitter, J. P., Westinghouse Lamp Division, Bloomfield, N. J.
Reed, B. A., Jersey Central Power and Light Company, Asbury Park, N. J.
Romano, B. A., United States Army Signal Corps, c/o Postmaster, New York, N. Y.
Shackelford, B. E. (Member re-election), R C A, New York, N. Y.
Storms, C. F. (Member), E. B. Badger and Son Company, New York, N. Y.
Stevens, E. R., New York Transit Systems, New York, N. Y.
Sutton, W. J., Ford, Bacon and Davis, Inc., New York, N. Y.
Swendeman, H. A., Westinghouse Electric and Manufacturing Company, New York, N. Y.
Vart, A. J. (Associate re-election), Geo. G. Sharp, New York, N. Y.
Wilcox, D. R., Morganite Brush Company, Long Island City, N. Y.

4. Southern

Demetroulas, N. P., United States Army, Ft. Eustis, Va.
Herman, G. R. (Member), Chicago Bridge and Iron Company, Morgan City, La.
Hunter, J. B., Taylor Parker Company, Inc., Norfolk, Va.
Raine, R. W. (Associate re-election), Robert and Company, Jacksonville, Fla.
Sinclair, W. D. (Member), South Carolina Public Service Authority, Charleston, S. C.
Smoke, C. H. (Member), U. S. Engineer Office, Norfolk, Va.

5. Great Lakes

Applegate, E. G. (Member), Crane Company, Chicago, Ill.
Bastis, E. T., Federal Cartridge Corporation, New Brighton, Minn.
Brackney, H. W. (Member), General Electric X-Ray Corp., Chicago, Ill.
Crossett, G., A. O. Smith Corporation, Milwaukee, Wis.
McGee, H. S., Public Service Company of Northern Illinois, Maywood, Ill.
Mills, G. R., Union Electric Company of Illinois, Venice, Ill.
Misegades, E. L., General Electric Company, Fort Wayne, Ind.
Monthei, L. J., K. R. Brown, Consulting Engineer, Des Moines, Iowa.
Ordas, A. F., General Electric Company, Ft. Wayne, Indiana.
Rich, N. S., Milwaukee County Highway Commission, Milwaukee, Wis.
Robison, R. D. (Associate re-election), Commonwealth and Southern Corporation, Jackson, Mich.
Stout, C. H., Schweitzer and Conrad Inc., Chicago, Ill.
Walters, W. W., Illinois Bell Telephone Company, Chicago, Ill.
Winterringer, R. T., James Stewart and Company, Inc., Chicago, Ill.
Zimmerman, W. R., Public Service Company of Northern Illinois, Maywood, Ill.

6. North Central

DeBaun, H. L. (Member), U. S. Engineers, Lowry Field, Denver, Colo.
Hills, W. B., United States Army, Fort F. E. Warren, Wyo.
Miller, H. D., The Central Nebraska Public Power and Irrigation District, Hastings, Nebraska.
Pappas, C., 2424 T Street, Lincoln, Nebraska.
Rook, C. W., University of North Dakota, Grand Forks, N. Dak.

7. South West

Downey, J. J., Dallas Power and Light Company, Dallas, Tex.
Green, F. S., Frank Adam Electric Company, St. Louis, Mo.
Hardy, C. H., Southwestern Bell Telephone Company, Wichita, Kansas.
Johnson, H. R., Appleton Electric Company, Dallas, Tex.
Poole, G. C., P. O. Box 1, Marlin, Tex.

8. Pacific

Adams, D. K., United States Army, c/o Postmaster, San Francisco, Calif.
Fayer, W., Bureau of Power and Light, Los Angeles, Calif.
Fleissner, C. L., Stoddart Aircraft Radio Company, Hollywood, Calif.
Furlong, L. R., Navy Department, San Francisco, Calif.
Gustafson, H. C., Pacific Gas and Electric Company, San Francisco, Calif.
Hunt, H. H., Fleet Operation Base, Roosevelt Base, Terminal Island, Calif.
Loper, W. B. (Member), California Electric Power Company, Riverside, Calif.
Mascovich, J. S., Joseph Bonadiman and Associate, Los Angeles, Calif.
Sorteberg, J. (Member), Basic Magnesium, Inc., Las Vegas, Nev.
Tugby, E. E. (Associate re-election), Pacific Electric Manufacturing Corporation, San Francisco, Calif.

9. North West

MacFarlane, J. C., Siems, Drake, Puget Sound, Seattle, Wash.
McKinney, H. H., The Austin Company, Seattle, Wash.
Moen, A. J., Washington Water Power Company, Spokane, Wash.
Olson, A. M., U. S. Army Engineers, Salt Lake City, Utah.

10. Canada

Clarke, G. T., Royal Canadian Signal Corps, Vimy Barracks, Kingston, Ont.
Farnham, D. M. (Member), Montreal Light, Heat and Power Consolidated, Montreal, Que.
Garcia, P. B., Royal Canadian Signal Corps, Vimy Barracks, Kingston, Ont.
Hyde, G., Royal Canadian Signal Corps, Vimy Barracks, Kingston, Ont.
Leuthold, A. (Member), Swiss Electric Company of Canada Ltd., Montreal, P. Q.
Way, W. R. (Member), Shawinigan Water and Power Company, Montreal, P. Q.

Total, United States and Canada, 94

Elsewhere

Boggis, A. G., H. M. Dockyard School, King's College, Portsmouth, England.
Campbell, I. R., Power Station, Tarata Taranaki, New Zealand.
Dunster, M. R., Hydro Electric Commission, Hobart, Tasmania, Australia.
Hinojosa, J. A., Instituto Politecnico Hinojosa, Inc., Cochabamba, Bolivia, South America.

Total, elsewhere, 4

Report of the Board of Directors

THE BOARD OF DIRECTORS of the American Institute of Electrical Engineers presents herewith to the membership its 58th annual report, for the fiscal year ending April 30, 1942. A general balance sheet showing the condition of the Institute's finances on April 30, 1942, together with other detailed financial statements, is included herein. This report contains a brief summary of the principal activities of the Institute during the year, more detailed information having been published from month to month in *Electrical Engineering*.

BOARD OF DIRECTORS' MEETINGS

The board of directors held five meetings during the year, four in New York, N. Y., and one in Toronto, Ont.

Information regarding many of the more important activities of the Institute which have been under consideration by the board of directors and the committees is published each month in the section of *Electrical Engineering* devoted to Institute activities.

DEFENSE AND WAR ACTIVITIES

In accordance with a resolution adopted by the board of directors on June 27, 1940, offering the services of the Institute to the President of the United States in connection with national defense problems, the board, committees, Sections, and headquarters staff have co-operated fully at every opportunity.

In addition to the organization of a committee on national defense, and a committee on civil protection, the Institute appointed a representative on the National Technological Civil Protection Committee and five representatives on the Engineers' Defense Board.

Co-operation has been extended in many undertakings, including the National Roster of Scientific and Specialized Personnel, census of engineering construction firms, extension of subcontracting plans, study of supply of and demand for engineers, and others.

President D. C. Prince delivered his address on the subject of postwar planning at meetings of many Sections and other organizations, and it was received with keen interest.

Editor G. Ross Henninger has contributed a substantial amount of his time weekly, since January 23, 1942, to the United States Navy Department, in Washington, in the organization of an editorial and publication review section for the coordination of Navy technical material.

Assistant Editor W. R. MacDonald, Jr., as a first lieutenant in the United States Army Signal Corps Reserve, was called into active service in January 1941 and has since been promoted to the rank of captain. He is responsible for the preparation and distribution of technical material used throughout the Signal Corps.

PRESIDENT'S AND NATIONAL SECRETARY'S VISITS

President Prince and National Secretary H. H. Henline attended the summer and Pacific Coast conventions, winter convention, South West District meeting in St. Louis, Mo., Southern District meeting in New Orleans, La., and the North Eastern District meeting in Schenectady, N. Y. President Prince and National Secretary Henline will attend the summer convention in Chicago, Ill. In May, the president will visit the Cleveland Section, and the national secretary will visit the Rochester Section.

Places Visited by President Prince

Alabama
Alabama Section, Birmingham
Muscle Shoals Section

Arizona
Arizona Section, Phoenix

California
Los Angeles Section
San Diego Section
San Francisco Section

Colorado
Denver Section
Conference on student activities, North Central District (6), Fort Collins

District of Columbia
Washington Section

Georgia
Georgia Section, Atlanta

Kentucky
Louisville Section

Louisiana
Southern District meeting, New Orleans

Maryland
Maryland Section, Baltimore

Massachusetts
Boston Section
Pittsfield Section

Michigan
Michigan Section, Detroit

Missouri
South West District meeting, St. Louis

New York
New York Section
Syracuse Section
North Eastern District meeting, Schenectady

Ohio
Cincinnati Section and University of Cincinnati Branch, joint meeting.

Oklahoma
Tulsa Section

Oregon
Portland Section

Pennsylvania
Erie Section
Lehigh Valley Section, Scranton
Philadelphia Section
Pittsburgh Section, and University of Pittsburgh, Carnegie Institute of Technology, and West Virginia University Branches, joint meeting

Tennessee
East Tennessee Section, Athens
Memphis Section

Texas
Houston Section
New Mexico-West Texas Section, El Paso
North Texas Section, Dallas
South Texas Section, San Antonio

Washington
Seattle Section
Spokane Section

Yellowstone National Park
Pacific Coast convention
Conference on student activities, Districts 8 and 9

Canada
Summer convention, Toronto
Vancouver Section
Engineering Institute of Canada, Montreal

Mexico
Mexico Section, Mexico City

Places Visited by National Secretary Henline

Indiana
South Bend Section
University of Notre Dame Branch, South Bend

Louisiana
Southern District meeting, New Orleans
Southern District executive committee meeting
Southern District conference on student activities

Massachusetts
Worcester Section

Missouri
South West District meeting, St. Louis

Nebraska
Nebraska Section, Omaha

New York
Ithaca Section
North Eastern District meeting, Schenectady

North Carolina
North Carolina Section, Durham

Ohio
Columbus Section

Virginia
Virginia Section, Richmond
University of Virginia Branch, Charlottesville

West Virginia
West Virginia Section, Charleston

Wisconsin
Madison Section

Yellowstone National Park
Pacific Coast convention
Conference on student activities, Districts 8 and 9

Canada
Summer convention, Toronto
Engineering Institute of Canada, Montreal

ANNUAL MEETING

The annual business meeting of the Institute was held on Tuesday morning, June 17, 1941. The annual report of the board of directors for the fiscal year which ended April 30, 1941, was presented in abstract by the national secretary. A report on the finances of the Institute was presented by National Treasurer W. I. Slichter. The report of the committee of tellers upon the election of officers for the year beginning August 1, 1941, was presented, and President-Elect Prince responded to his introduction with a brief address. During this session, there was an address by Doctor Thomas H. Hogg, chairman and chief

engineer of the Hydro-Electric Power Commission of Ontario, and the Lamme Medal for 1940 was presented to Doctor Comfort A. Adams, consulting engineer, Edward G. Budd Manufacturing Company, Philadelphia, Pa.

NATIONAL CONVENTIONS

Three national conventions were held during the year, and a brief report on each follows:

Summer Convention. The 57th summer convention was held in Toronto, Ont., June 16–20, 1941. In addition to the annual business meeting, and conference of officers, delegates, and members, there were ten technical sessions, five technical conferences, and one general session, at which Howard Coonley, of the Walworth Company, gave an address entitled "Making Democracy Work." Entertainment features of the convention were an English tea, bridge, dance, banquet, and golf and tennis tournaments. Many inspection trips were held. The registration was 1,203.

Pacific Coast Convention. The 29th Pacific Coast convention was held in Yellowstone National Park, August 27–29, 1941, with a registration of 322. A conference on "After the Emergency, What?" was a feature of the program, which also included three technical sessions, two technical conferences, one general session, two student sessions, and a conference on student activities. Entertainment features included an informal dinner and dancing, boat trip, inspection trips, and ladies' events

Winter Convention. The 30th winter convention was held in New York, N Y., January 26–30, 1942, with a program including 20 technical sessions, at which more than 70 papers were presented, and 6 technical conferences. At the general session, N. G. Symonds, consultant on co-ordination of conservation orders, War Production Board, gave an address entitled "The Engineer's Contribution to the War Effort," and the Alfred Noble Prize was presented to Robert F. Hays, Jr. At an evening meeting, the Edison Medal was presented to Doctor John B. Whitehead, professor of electrical engineering, The Johns Hopkins University, Baltimore, Md. A smoker, dinner dance, and events for women guests completed the program. The registration was 1,331.

DISTRICT MEETINGS

South West District Meeting. This meeting was held in St. Louis, Mo., October 8–10, 1941, with 530 members and guests attending. Seven technical sessions, one general session, and two technical conferences were held. An address by E. T. Gushee, executive vice-president, Union Electric Company of Missouri, on "Electric Utilities' Part in National Defense" was given at the general session, and postwar problems were discussed at a general luncheon at which Doctor William McClellan, president, Union Electric Company, presided, and President Prince gave his address on postwar planning. Entertainment features consisted of a smoker, banquet and dance, women's bridge, and many inspection trips.

Southern District Meeting. The fourth meeting of this District was held in New Orleans, La., December 3–5, 1941. One general session, two technical sessions, and two student sessions were held at which eight papers were presented, in addition to the annual District conference on student activities. Entertainment consisted of a banquet, dancing, golf, and many inspection trips. The attendance was 384.

North Eastern District Meeting. This meeting, held in Schenectady, N. Y., April 29–May 1, 1942, was of wide interest on account of the quality and diversity of the program. There were one general session, three technical sessions, seven conferences, one student session, a joint luncheon with the Schenectady section of The American Society of Mechanical Engineers, a conference on student activities, a banquet, the Steinmetz memorial lecture, inspection trips, and other features. Attendance was about 500.

SECTIONS

During the year, the Sections committee recommended to Section chairmen that (*a*) plant engineers groups be formed, especially in the industrial centers, (*b*) efforts be made by the Sections to reinterest executives no longer engaged in technical work, (*c*) consideration be given to the desirability of organizing local engineering councils, and having some Section meetings devoted to civic affairs or related nontechnical subjects, (*d*) the Sections send announcements of their meetings to their members serving in the armed forces, (*e*) the Sections encourage their members to take keen interest in the development of plans for return to peacetime conditions, and (*f*) the interest in student guidance work in the Sections be increased.

President Prince gave his address on postwar planning at meetings of many of the Sections, and the keen interest with which it was received produced extensive discussions.

At its January meeting the board of directors voted to assign to Sections all remaining unassigned territory within the United States.

A majority of the Sections included in their programs during the year various phases of war activities.

Table I contains information regarding Sections and Branches and their meetings during the past several years. Detailed information on their activities of the past year may be found in the annual report on Section and Branch activities in the June 1942 issue of *Electrical Engineering*, pages 322–3.

STUDENT BRANCHES

A new Branch was organized at the University of Delaware, bringing the total number to 124.

The committee on Student Branches transmitted to all counselors pamphlet copies of Doctor William E. Wickenden's address "The Second Mile" (*Electrical Engineering*, May 1942, pages 242–7), suggesting that it be brought to the attention of students as an excellent statement of the nature of the engineering profession.

The committee on safety again urged the Branches to hold meetings on safety subjects, and transmitted detailed suggestions regarding such meetings.

The terms of 1,761 enrolled students were expected to expire on April 30, 1942. Of these, 935, or about 53 per cent, applied for admission as Associates.

See references at end of the preceding report on Sections.

General Committees

FINANCE COMMITTEE

In recommending a budget for the current appropriation year beginning October 1, 1941, the finance committee estimated that, in spite of the further loss of overseas revenue and loss from members in the United States enrolled in military service, the income for the current year would be approximately the same as that received during the previous appropriation year ending September 30, 1941, these losses being offset by the continued net increase in the membership of the Institute. So far, this expectation appears to be justified.

Accordingly, the budget was set up on the basis of $337,000, approximately $20,000 more than was expended last year. This has made possible a modest increase in the scope of the Institute activities in many departments including the publication of more technical material, some increases in salary to junior members of the staff and the addition of two people, a more liberal provision for the pension fund, and some increase in provision for travel, particularly for District student conferences. While the budget provides for some increases in expenses in

Table I. Section and Branch Statistics

	For Fiscal Year Ending April 30					
	1937	1938	1939	1940	1941	1942
Sections						
Number of Sections	62	65	67	70	72	72
Number of meetings held	621	624	635	701	703	647
Total attendance	74,950	110,148	85,692	91,949	92,554	78,254
Branches						
Number of Branches	119	120	120	121	123	124
Number of meetings held	1,363	1,334	1,190	1,346	1,163	946
Total attendance	46,121	60,446	53,380	64,972	52,285	37,785

addition to salaries, the budget includes an item of unappropriated funds of about $7,000, which it is anticipated should provide for additional necessary items and also for such further increase in the cost of materials as may take place during the year.

In taking care of the Institute's investment funds, the conservative policy of last year has been continued. About 20 per cent of the funds are invested in common stocks of essential industries and the bulk of the remainder is invested in United States Government bonds. Details of the Institute's investments are shown in Schedule 1 on page 379.

The Institute's healthy financial condition is the result of the policy continued over many years of budgeting expenses on the basis of the anticipated revenue and keeping the expenses within this budget limit. To the accomplishment of this, all parts of the Institute organization, and particularly the staff, have contributed. As a result, there has been built up over the life of the Institute a reserve fund of about $250,000, or about three-fourths of a year's expenses at the current level. In these disturbed times, it is very reassuring to have this modest insurance against any sudden great change in the Institute's income or expenses that might result from the war.

TECHNICAL PROGRAM COMMITTEE

Convention Programs. Three national conventions and three District meetings were held during the year. The total attendance of these six meetings represents a 1.5 per cent decrease as compared with the total attendance of five meetings held during the previous year. The attendance for the present year was unusually good when it is considered that the attendance at three of the meetings of the previous year each established a record over corresponding meetings in respective localities. When compared with the year ending April 30, 1939, in which six meetings were held, the attendance for the past fiscal year represents a 4.0 per cent increase. The 73 technical sessions and conferences at the six meetings were sponsored by 15 different Institute committees. Five of the technical committees held no sessions during the year.

The committee has arranged programs to be of the greatest service to the nation's war effort, in so far as possible. Five sessions and conferences of immediate importance to the war effort were held during the winter convention. These sessions were among the best attended, and in the planning of future programs sessions directly related to problems arising from the war will take precedence.

Civic Affairs Conferences. Several conferences on civic affairs have been held during the year to survey and determine how engineers can render the most effective service in their communities during the war and in the postwar period. In a conference on "After the Emergency, What?" held during the Pacific Coast convention, President Prince presented a plan based on studies made in the General Electric Company with a view to maintaining a high level of production during the peace to follow, and to prevent unemployment. Similar studies of business in various communities, states, and throughout the United States have been encouraged through discussions at subsequent conventions and Section meetings. A conference on "How Can Engineers Render Greater Public Service?" was held during the South West District meeting in St. Louis, Mo. Reports were submitted by 14 local engineering groups or councils on "The Contributions of Local Engineering Councils to Their Communities." Another such conference was held during the winter convention, in which a report of the St. Louis conference was presented by F. A. Cowan, vice-chairman of the technical program committee. "Regional Planning in the State of Pennsylvania" was described by R. H. Smith, deputy secretary, department of commerce, Commonwealth of Pennsylvania. Detailed reports of these two conferences on civic affairs were published in *Electrical Engineering*, March 1942, pages 148–52. Arrangements have been made to hold a similar conference on local engineering councils during the summer convention in Chicago.

Table II. Technical Programs, Last Four Years

	Year Ending April 30			
	1942	1941	1940	1939
Number of national conventions	3	3	2	3
Number of District meetings	3	2	3	3
Registration at national conventions and District meetings	4,274	4,339	3,548	4,100
Number of papers presented	182	195	177	184
Number of papers recommended for *Transactions*	152	167	151	169
Estimated number of pages required for printing papers in *Transactions*	807*	938*	886*	986*
Average length of papers recommended for *Transactions*	5.3	5.72	5.86	5.83
Number of technical sessions	50	46	43	50
Number of technical conferences	23	18	10	12

* Partly estimated.

Restricted Sessions. When subjects on which secrecy is required are discussed, closed committee meetings are held. During the winter convention, a session and conference on air transportation were successfully held with the attendance limited to AIEE members who are United States citizens and a few other strictly accredited individuals.

Conferences. During the war period, especially, technical conferences with a minimum of time-consuming formalities are encouraged. The accompanying tabulation shows that a greater number of conferences has been held during the past year than ever before, bringing their total number to 95 since their origin at the summer convention at Ithaca, N. Y., in 1935. The smaller number of technical papers presented, together with the maintained attendance at conventions, reflect the increasing importance of the conference method in providing up-to-the-minute reports of new developments, and free discussion of controversial questions.

General Sessions. A general session was held at each meeting during the year. Preference has been continued for addresses dealing with the broader problems of the profession, as related to co-operative effort during and after the war period, rather than toward specific technical developments. The general session of the 1942 summer convention will present some of the problems of engineering executives for the consideration of Institute members, through a discussion of "Organization and Management of Large-Scale Engineering Work."

Acknowledgments. The committee gratefully acknowledges the interest and efforts of its members and the work of the chairmen of the technical committees and the members of the headquarters staff.

PUBLICATION COMMITTEE

Electrical Engineering, *Transactions*, and advance pamphlet copies of technical program papers were published during the fiscal year in general on the same basis as for the preceding year.

The program and policy for expediting the publication of AIEE *Transactions* material that was initiated at the summer convention in Swampscott, Mass., in 1940, involved among others three related objectives.

The primary among these objectives was the earlier publication of *Transactions* material. This objective was achieved, effective with the January 1942 issue of *Electrical Engineering*. The first of the 1942 winter convention papers were published in the *Transactions* section of that issue, and the publication of the entire program of winter convention *Transactions* material will be completed with the June 1942 issue of *Electrical Engineering* and the corresponding June "Supplement to *Electrical Engineering*—*Transactions* Section." This latter supplement will, in contrast to the several previous issues, be down to what is considered normal size—200 pages or less. Also normal with respect to content, it will carry all the published discussions of 1942 winter convention papers but only a very few of the papers themselves—those which for some special reason could not be accommodated in the *Transactions* sections of the previous monthly issues of *Electrical Engineering*.

Requirements of the first objective imposed a second—that the publication of all 1941 papers and discussions and those remaining from 1940 be completed with the 1941 *Transactions* and the corresponding issues of *Electrical Engineering*.

This objective was achieved as originally scheduled, although as expected the program resulted in great enlargement of the June and December 1941 "Supplements" and imposed a delay of several weeks in the

completion and distribution of the 1941 *Transactions* volume. These latter manifestations were incidental to the transition in publication procedure, and should not be encountered in the ensuing normal application of the Swampscott program.

A third objective of the Swampscott program was that each annual volume of AIEE *Transactions* should contain all, *and only*, the technical program papers and related discussions presented during the corresponding calendar year and other appropriate record material for that year. The 1942 volume is expected to meet this objective.

The achievement of these desired results imposed many added burdens on the headquarters staff and introduced many transient difficulties into the work of the several committees responsible for the development of technical program material. The publication committee is duly appreciative of the effective co-operation of all parties involved.

World war conditions as of May 1, 1942, have introduced certain problems in the conduct of the Institute's publication service that seem worthy of recording. One of these relates to the matter of censorship-export control of the distribution of the monthly issues of *Electrical Engineering* to members and nonmember subscribers in all foreign countries and territories except Canada. Distribution has been entirely stopped in Asia to Burma, Japan, Netherlands Indies, Philippine and other islands, occupied portions of China, Malayan states, Indo-China, and other enemy-dominated territory; in Europe to all points except Great Britain, Turkey-in-Europe, and Russia. This affects about 230 members and 34 subscribers. Distribution to members and subscribers in Central and South America and the other remaining world points now is being made under export-license control and rigorous limitations imposed by the United States Office of Censorship and the Office of Export Control of the Board of Economic Warfare. Currently this affects about 720 Institute members and 205 subscribers.

MEMBERSHIP COMMITTEE

Membership of the Institute at the end of the fiscal year reached an all-time high record for that date of 18,944 exceeding the former peak year of 1927 by 600 members. This very creditable showing was undoubtedly the result of the hard work and unselfish efforts of the members of the Section membership committees, Branch counselors and members of the national membership committee, comprising approximately 700 Institute members engaged in membership work. This result was made possible to a considerable extent by the splendid response of the members of the Institute at large to the broadcast letter of the chairman, dated October 8, 1941, in which they sent in the names of 989 prospects, many of whom are now members. With the pressure of the war effort and unexpected demands upon the time of membership committee personnel, the amount of effort applied to Institute membership work is another indication of the fine spirit of loyalty which binds members of the Institute together in a national organization of their profession.

Table III shows that the gross increase in membership during the year was 1,863 and that this was reduced to a net increase of 1,058 by membership losses during the year. In the preceding year the gross increase was 1,644, reduced to a net increase of 673 by losses during that year. Analysis of the losses as between these two years is of interest in manifesting effective effort of membership committees in connection with delinquent members.

	Year Ending April 30	
	1941	1942
Resigned	299	211
Dropped	582	484
Total	881	695

Table IV shows the number of applications received from enrolled students and others annually for the past five years. It shows a continuous increase each year. Since applications received during the fiscal year are not all acted upon at the close of the fiscal year, there is no direct check between Tables III and IV. The Branch counselors have co-operated with the committee by writing to graduates and using their influence to procure their applications. The Section membership committees receive from headquarters the cards of graduates residing in their territory and endeavor to interview them with respect to membership.

Table III. Membership Statistics for Fiscal Year Ending April 30, 1942

	Honorary Member	Fellow	Member	Six-Year Associate	Associate	Increase	Total
Membership on April 30, 1941	8	778	4,650	5,890	6,560		17,886
Additions							
New members qualified		3	179	24	1,614		1,820
Former members reinstated		1	8	10	24		43
Subtotal		4	187	34	1,638		1,863
Transfers		37	226	726			
	8	819	5,063	6,650	8,198		20,738
Deductions							
Died	3	22	31	43	11	−110	
Resigned		2	47	93	69	−211	
Dropped		3	45	166	270	−484	
Subtotal	3	27	123	302	350	−805	
Transfers			37	203	749		
	3	27	160	505	1,099		1,794
Membership on April 30, 1942	5	792	4,903	6,145	7,099	1,058	18,944

Table IV. Number of Applications Received From Enrolled Students and From All Others

Year Ending April 30	Students	All Others	Total
1942	971	1,031	2,002
1941	887	1,011	1,898
1940	911	918	1,829
1939	849	872	1,721
1938	739	932	1,671

Table V. Number of Enrolled Students as of April 30

Year	New Applications	Renewals	Total
1942	2,585	3,377	5,962
1941	2,351	3,188	5,539
1940	2,525	2,992	5,517
1939	2,271	2,971	5,242
1938	2,428	2,609	5,037

Table VI. Number of Members in Section Territory Reinstated

August 1, 1941 to April 30, 1942	275
Year beginning August 1, 1940	383
Year beginning August 1, 1939	302
Year beginning August 1, 1938	354
Year beginning August 1, 1937	325

Table VII. Status of Membership Dues as of April 30

Year	Total Membership	Members Fully Paid	
		Number	Per Cent
1942	18,944*	16,595**	87.5
1941	17,886	15,777	88.2
1940	17,213	14,997	87.1
1939	16,605	14,371	86.5
1938	16,078	14,127	87.9

* Of the 18,944 members reported for April 30, 1942, 2,349 were not fully paid. Of this number, 327 names are being carried upon the membership rolls, in an inactive status, in accordance with the resolutions adopted by the Board of Directors in the interest of members in the military service of the United States or allied countries, or members located in such countries unable to remit membership dues at this time. The remainder comprises

1. Members owing dues to April 30, 1941..... 514
2. Members owing dues to April 30, 1942.....1,508

(During the period May 1 to May 20, 1942, 316 members have paid dues to April 30, 1942, reducing the number not fully paid to 1,192.)

** Including 733 Members for Life.

Table V shows data on the number of enrolled students and new applications therefrom for five successive years ending 1942. The improvement in 1942 is especially encouraging.

Tables VI and VIII show additional data on membership which are self-explanatory.

The membership committee continued the organization adopted in the preceding year which provided an advisory subcommittee, comprising committee members within easy reach of New York and thus able to hold more frequent meetings than the whole committee, and a research subcommittee to which were referred committee problems requiring study and research. This organization has been found excellently adapted to the membership committee, and permits of holding but one meeting of the committee as a whole, during the winter convention, when a good attendance is assured.

The Membership Committee Guide, a pamphlet prepared and distributed in the preceding year, which outlines recommended procedure for the conduct of Section membership committee work, has been found very helpful to Section membership committees.

In June 1941, a letter was written to each of the newly elected Section chairmen suggesting the early appointment of Section membership committees, in order that such committees can get an early start. This letter was well received by Section chairmen, and undoubtedly aided in getting membership work started early during the current committee year. This is important because of the time required to get committees organized and working, and the shortness of the period when most effective work can be done.

The research subcommittee has studied

Table VIII. Record of AIEE Membership

Year	Total May 1	Year	Total May 1	Year	Total May 1
1884	71	1905	3,460	1925	17,319
1885	209	1906	3,870	1926	18,158
1886	250	1907	4,521	1927	18,344
1887	314	1908	5,674	1928	18,265
1889	333	1909	6,400	1929	18,133
1890	427	1910	6,681	1930	18,003
1891	541	1911	7,117	1931	18,334
1892	615	1912	7,459	1932	17,550
1893	673	1913	7,654	1933	17,019
1894	800	1914	7,876	1934	15,230
1895	944	1915	8,054	1935	14,269
1896	1,035	1916	8,202	1936	14,600
1897	1,073	1917	8,710	1937	15,308
1898	1,098	1918	9,282	1938	16,078
1899	1,133	1919	10,352	1939	16,605
1900	1,183	1920	11,345	1940	17,213
1901	1,260	1921	13,215	1941	17,886
1902	1,549	1922	14,263	1942	18,944
1903	2,229	1923	15,298		
1904	3,027	1924	16,455		

Table IX. Deaths of AIEE Members Reported in "Electrical Engineering"

Name	Date of Election	Date of Death	Grade at Death	Obituary Notice in Electrical Engineering
Aldrich, W. S.	Associate '92	Dec. 22, 1941	Member	Mar. 1942, p. 167
Anderson, E. F.	Associate '35	Oct. 4, 1941	Associate	Dec. 1941, p. 604
Arnold, B. J.	Associate '92	Jan. 30, 1942	Honorary Member	Mar. 1942, p. 166
Augustinus, P.	Member '27	Nov. 18, 1941	Member	Feb. 1942, p. 96
Babcock, F. H.	Associate '28	Aug. 31, 1941	Associate	Oct. 1941, p. 507
Baker, T. S.	Associate '28	Feb. 27, 1941	Member	May 1941, p. 234
Barker, G. A.	Associate '41	June 18, 1941	Associate	Aug. 1941, p. 411
Barnard, G. H.	Member '26	May 6, 1941	Member	July 1941, p. 356
Belden, J. L.	Associate '36	Oct. 5, 1941	Associate	Mar. 1942, p. 167
Bennett, J. C.	Associate '90	Aug. 2, 1941	Member	Sept. 1941, p. 452
Berg, E. J.	Associate '94	Sept. 9, 1941	Fellow	Oct. 1941, p. 507
Berresford, A. W.	Associate '94	May 30, 1941	Fellow	July 1941, p. 355
Brandenstein, E. W.	Member '37	May 20, 1941	Member	July 1941, p. 356
Budden, D. B.	Member '29	April 19, 1941	Member	July 1941, p. 356
Burbank, E. W.	Associate '25	April 1941	Member	April 1942, p. 213
Canfield, C. E.	Associate '02	July 12, 1941	Member	Sept. 1941, p. 451
Carpenter, H. V.	Associate '03	Nov. 15, 1941	Fellow	Jan. 1942, p. 49
Case, H. M.	Associate '11	Mar. 31, 1941	Fellow	May 1941, p. 234
Clark, F. C.	Associate '12	Oct. 28, 1941	Associate	Feb. 1942, p. 96
Clarke, C. L.	Associate '84	Oct. 9, 1941	Fellow	Nov. 1941, p. 557
Clement, E. E.	Associate '97	Mar. 31, 1941	Fellow	Nov. 1941, p. 557
Combs, R. H.	Associate '13	April 25, 1941	Member	July 1941, p. 356
Conrad, Frank	Associate '02	Dec. 10, 1941	Fellow	Jan. 1942, p. 48
Cooper, D. W.	Associate '40	Sept. 29, 1941	Associate	Mar. 1942, p. 167
Cornell, E. S.	Associate '28	May 14, 1941	Member	July 1941, p. 356
Costello, J. M.	Associate '27	Aug. 15, 1941	Associate	Oct. 1941, p. 507
Crichton, L. N.	Associate '08	Sept. 6, 1941	Member	Oct. 1941, p. 507
Croden, W. T.	Associate '37	Jan. 12, 1942	Associate	Mar. 1942, p. 167
Cunningham, F. J.	Associate '19	April 1941	Associate	June 1941, p. 285
Cunningham, J. H.	Associate '06	Oct. 29, 1941	Associate	Feb. 1942, p. 96
Daugherty, W. W.	Associate '37	Aug. 12, 1941	Associate	Dec. 1941, p. 604
Dillman, C. L.	Associate '36	Apr. 27, 1941	Associate	July 1941, p. 357
Don Carlos, H. C.	Fellow '18	Mar. 29, 1941	Fellow	May 1941, p. 234
Eichberg, F.	Fellow '28	July 30, 1941	Fellow	Sept. 1941, p. 451
Elliott, F. F.	Associate '19	May 8, 1941	Associate	Dec. 1941, p. 604
Emmett, W. L.	Associate '93	Sept. 26, 1941	Honorary Member	Nov. 1941, p. 557
Fraser, W. W.	Associate '21	Mar. 31, 1941	Member	July 1941, p. 356
Gherardi, B.	Associate '95	Aug. 14, 1941	Fellow	Sept. 1941, p. 450
Gerry, M. H.	Associate '93	Dec. 30, 1941	Fellow	Apr. 1942, p. 213
Gibney, E. L.	Member '40	Feb. 26, 1942	Member	Apr. 1942, p. 214
Gladson, W. N.	Associate '98	Oct. 18, 1941	Member	Jan. 1942, p. 49
Guillou, A. V.	Member '27	Dec. 1940	Member	Sept. 1941, p. 451
Hall, C. E.	Associate '09	Feb. 16, 1941	Associate	July 1941, p. 356
Harley, E. A.	Associate '06	July 9, 1941	Associate	Sept. 1941, p. 452
Hehre, F. W.	Associate '13	July 27, 1941	Fellow	Sept. 1941, p. 452
Henshaw, F. V.	Associate '89	Mar. 23, 1941	Member	May 1941, p. 233
Imlay, L. E.	Associate '00	June 9, 1941	Fellow	July 1941, p. 355
Irwin, E.	Associate '12	Nov. 3, 1941	Associate	Jan. 1942, p. 49
Kemp, C. G. R.	Member '34	Nov. 3, 1941	Member	Jan. 1942, p. 49
Koch, P. W.	Associate '28	Sept. 2, 1941	Associate	Mar. 1942, p. 167
Kovediaeff, B. E.	Associate '28	April 1941	Associate	Mar. 1942, p. 167
Lacerte, W. J.	Associate '28	Oct. 12, 1940	Associate	Sept. 1941, p. 452
Lanier, A. C.	Associate '04	Feb. 26, 1942	Fellow	Apr. 1942, p. 213
Lawler, G. S.	Associate '11	Oct. 31, 1941	Member	Dec. 1941, p. 604
Leonarz, E.	Associate '08	July 24, 1941	Fellow	Oct. 1941, p. 507
Lloyd, M. G.	Associate '08	Apr. 26, 1941	Fellow	June 1941, p. 295
Lyle, R. E.	Associate '32	July 20, 1941	Associate	Sept. 1941, p. 452
MacNaughton, A. K.	Associate '21	March 1941	Fellow	May 1941, p. 234
Magnusson, C. E.	Associate '05	July 10, 1941	Fellow	Aug. 1941, p. 411
Mahaney, D. J.	Associate '34	Nov. 28, 1941	Associate	Apr. 1942, p. 214
Marquis, J. B.	Associate '20	June 5, 1941	Associate	Jan. 1942, p. 49
McDougall, S.	Associate '34	Dec. 23, 1941	Associate	Mar. 1942, p. 167
Morganthaler, P. C.	Associate '09	Mar. 29, 1941	Associate	July 1941, p. 356
Morton, G. L.	Associate '08	Apr. 26, 1941	Fellow	June 1941, p. 295
Moser, F. L.	Associate '25	Mar. 25, 1941	Member	May 1941, p. 234
Mulligan, J. F.	Associate '29	Feb. 6, 1941	Member	May 1941, p. 234
Murray, W. S.	Associate '03	Jan. 9, 1942	Fellow	Feb. 1942, p. 96
Murrie, J. L.	Member '41	Aug. 16, 1941	Member	Nov. 1941, p. 557
Nyswander, R. E.	Member '22	Apr. 8, 1941	Member	June 1941, p. 295
Otis, J. P.	Associate '27	Feb. 17, 1941	Associate	Sept. 1941, p. 451
Patterson, A.	Associate '08	Apr. 4, 1941	Member	June 1941, p. 295
Patterson, J. H.	Associate '39	July 19, 1941	Associate	Mar. 1942, p. 167
Petterson, R. H.	Associate '37	Jan. 8, 1942	Associate	Mar. 1942, p. 167
Phelps, J. E. B.	Member '29	April 24, 1941	Member	July 1941, p. 357
Plowman, C. S.	Associate '20	Feb. 7, 1942	Associate	Apr. 1942, p. 213
Poirier, A. E.	Associate '01	Dec. 17, 1941	Associate	Feb. 1942, p. 97
Porter, N. M.	Associate '31	May 29, 1941	Associate	Sept. 1941, p. 452
Purdy, H. T.	Associate '13	Jan. 31, 1940	Member	Sept. 1941, p. 451
Richhart, W. S.	Associate '08	Apr. 9, 1941	Member	June 1941, p. 295
Ripley, L. O.	Associate '05	July 22, 1941	Associate	Sept. 1941, p. 451
Roe, J.	Associate '06	Nov. 24, 1941	Associate	Feb. 1942, p. 97
Rothenstein, O.	Associate '28	Oct. 20, 1941	Associate	Feb. 1942, p. 96
Rugg, H. V.	Associate '07	Sept. 21, 1941	Member	Feb. 1942, p. 97
Sampson, F. D.	Associate '96	Aug. 24, 1941	Member	Oct. 1941, p. 507
Sanville, H. F.	Associate '01	May 24, 1941	Member	July 1941, p. 356
Schaeffer, R.	Associate '32	Apr. 18, 1941	Member	June 1941, p. 295

(*Continued on following page*)

Table IX (continued). Deaths of AIEE Members Reported in "Electrical Engineering"

Name	Date of Election	Date of Death	Grade at Death	Obituary Notice in Electrical Engineering
Schalcher, O.	Associate '39	Nov. 3, 1941	Associate	Mar. 1942, p. 167
Schreiber, J. M.	Associate '03	July 18, 1941	Associate	Sept. 1941, p. 451
Schumacher, J. H.	Associate '07	Apr. 1, 1941	Member	May 1941, p. 233
Scott, W. M.	Associate '97	Jan. 19, 1942	Associate	Mar. 1942, p. 167
See, A. B.	Associate '93	Dec. 16, 1941	Associate	Feb. 1942, p. 97
Smith, E. F.	Associate '07	Nov. 13, 1941	Fellow	Feb. 1942, p. 97
Smith, J. C.	Associate '20	July 18, 1941	Associate	Sept. 1941, p. 452
Stebbins, T.	Associate '89	Oct. 14, 1941	Fellow	Nov. 1941, p. 557
Stockbridge, W. A.	Associate '11	Aug. 20, 1941	Associate	Dec. 1941, p. 604
Strike, R. J.	Associate '04	Nov. 2, 1941	Associate	Apr. 1942, p. 214
Swinburne, E. D.	Associate '08	Nov. 12, 1941	Associate	Feb. 1942, p. 97
Torchio, P.	Associate '95	Jan. 14, 1942	Fellow	Feb. 1942, p. 96
Van Gelder, H. M.	Associate '05	Nov. 22, 1941	Member	Feb. 1942, p. 96
Wagner, R. T.	Member '25	Feb. 11, 1942	Member	Apr. 1942, p. 214
Walther, J. T.	Associate '19	Nov. 4, 1941	Member	Jan. 1942, p. 49
Wanamaker, E.	Associate '20	August 1941	Associate	Apr. 1942, p. 214
Ward, H. A.	Associate '35	Recently	Associate	May 1941, p. 234
Whittemore, G. W.	Associate '02	Aug. 22, 1940	Associate	May 1941, p. 234
Yokich, M.	Associate '39	Feb. 12, 1942	Associate	Apr. 1942, p. 214

many problems during the year, the solution of which has contributed to the effectiveness of committee work. One example was its consideration of Doctor Sorensen's suggestion that an effort be made to reinterest members who have developed beyond the "design engineering" stage of their careers and who are now in managerial and executive positions. The result was a letter written to all Institute vice-presidents, District secretaries, and Section chairmen, by the chairman of the Sections committee, soliciting their assistance in a well-defined program for dealing with this problem.

In bringing the advantages of membership to the attention of desirable candidates for admission to the Institute, and in discussions with members about to drop their membership in the Institute, committee members have found that frequently the most effective appeal is that which places emphasis upon the value of the Institute as the national organization of the electrical engineering profession. In relation to present Institute members, and considering the substantial losses each year, it appears that there is opportunity to keep members better informed as to the work and accomplishments of the Institute as a national organization. This problem has also been studied by the research subcommittee and some suggestions have been made for the consideration of the board of directors.

BOARD OF EXAMINERS

The board of examiners held 11 meetings during the past year, averaging about two and one-half hours each, and acted upon 3,662 cases, divided as shown in Table X.

During the past year the board has had the opportunity to put to a practical test the "invitational method" applying to transfer to Fellow grade. This method was recommended by the examiners in December 1940. The first transfers were presented under this procedure in October 1941, and to date 13 cases have been considered, all receiving favorable recommendations. In the opinion of the examiners, all difficulties previously inherent in the Fellow transfer procedure thus have been cleared up.

A survey of the situation with regard to transfer to Member does not under present conditions seem to call for any alteration in the long-established application procedure followed in such cases. The record of the current year shows that of the 246 cases coming before the board only 14 failed to receive a favorable recommendation.

A change in procedure applying to re-elections to Member and Fellow was also put into effect during the past year. Up to April 1941, it had been customary to require applicants for re-election, out of the Institute for more than five years, to supply a new set of references. This requirement was waived in favor of a requirement that all re-election cases be posted in *Electrical Engineering* for a period of one month before formal action is taken, in order to provide for the filing of any possible objections based on ethical grounds, as, except for such ethical objections, a man is always considered eligible for re-election to the grade formerly held.

Table X. Applications for Admission and Transfer

Applications for Admission		
Recommended for grade of Associate	1,169	
Re-elected to the grade of Associate	68	
Not recommended	5	
		1,242
Recommended for grade of Member	167	
Re-elected to the grade of Member	17	
Not recommended	24	
		208
Recommended for grade of Fellow	2	
Re-elected to the grade of Fellow	1	
		3
Recommended for Honorary Member	1	
		1
Applications for Transfer		
Recommended for grade of Member	232	
Not recommended	14	
		246
Recommended for grade of Fellow	28	
Not recommended	0	
		28
Students		
Recommended for enrollment as Students		1,934
Total		3,662

HEADQUARTERS COMMITTEE

In accordance with a request from the board of directors, the committee recommended rules governing the use of AIEE headquarters rooms for meeting purposes. The rules were adopted by the board in January.

INSTITUTE POLICY COMMITTEE

The functions of the committees on economic status of the engineer and legislation affecting the engineering profession were consolidated with those of the Institute policy committee, to be carried out by that committee through subcommittees. During the year, the committee reported to the board of directors on several matters which had been referred to it.

COMMITTEE ON PLANNING AND CO-ORDINATION

A meeting of the committee was held at Institute headquarters in New York on January 27, 1942, at which, after careful consideration and thorough discussion of the probable effects of the war upon the summer convention, the members present unanimously adopted the following recommendations to the board of directors:

1. That the 1942 summer convention be held in Chicago as planned.

2. That the summer convention and technical program committees make it a working convention, with the understanding that the resolution on "summer convention policy" adopted by the board of directors on November 12, 1920, be disregarded in this case.

3. That the summer convention and technical program committees be requested to recommend the most desirable length of program.

At this meeting, the committee considered all requests from District and Section officers for national conventions and District meetings in 1943, and recommended to the board of directors the following schedule of meetings:

Winter convention, New York, N. Y., January 25–29

Summer convention, Cleveland, Ohio, June 21–25

Pacific Coast convention, about September 1; Pacific Coast Districts to be requested to give further consideration to the selection of the most desirable location.

District meetings—Tentative approval given to the following, subject to further review by the District committees or by the board of directors if conditions make it desirable:

North Eastern District (1), Providence, R. I., spring

Southern District (4), Virginia

South West District (7), Kansas City, Mo., spring

All of these recommendations were approved by the board of directors on January 29, 1942.

The committee had, previous to the meeting, considered the request of the Vancouver Section that the 1942 Pacific Coast convention be held in Vancouver, B. C., and, having consulted the vice-presidents of the three Districts concerned, recommended to the board of directors that the convention be scheduled in Vancouver for

September 9–11. This recommendation was approved by the board on October 24, 1941.

COMMITTEE ON CODE OF PRINCIPLES OF PROFESSIONAL CONDUCT

The committee still awaits advice from the joint committee on code of ethics sponsored by Engineers' Council for Professional Development, which has been delayed in its work some four months by the illness of its chairman who also is chairman of this committee. It now is hoped to have completed by the joint committee before the summer is over a report, which then can be considered by the AIEE committee. In association with this, the ECPD committee on professional recognition is endeavoring to formulate a statement of the principles which underlie a code of ethics and which give to ethics a fundamental influence on a profession.

The chairman of the AIEE committee while still ill received a written charge of unethical practices made against an engineer by another engineer, and this will shortly be circulated for consideration by all members of the committee on code of principles of professional conduct.

COMMITTEE ON CONSTITUTION AND BYLAWS

The work of this committee has been limited to a few routine changes in the bylaws. There has been no change in the constitution.

Sections 65, 74, and 83 were modified or deleted in keeping with the action of the board of directors, taken at its meeting of August 8, 1941, to consolidate the work of the committee on economic status of the engineer and the committee on legislation affecting the engineering profession into that of the Institute policy committee.

Section 92 was modified as to date only to make it consistent with the present rules of the John Fritz Medal board of award.

COMMITTEE ON RESEARCH

The committee is now in its second year as a general committee of the Institute rather than a technical committee. As in the preceding year, the principal activity has been that of studying the program of the Engineering Foundation research projects sponsored by the Institute.

One of these, research on the stability of impregnated-paper insulation, project 66, which has been under way for some years at the Johns Hopkins University under the immediate direction of Doctor J. B. Whitehead, will be terminated for the time being at the end of the current year. This termination does not mean that all study desirable regarding this question has been completed, but it does mean that the work is well under way with an indication as to how future work should be done by those who are particularly interested in this problem as it applies to the business of manufacturing apparatus using impregnated-paper insulation. Also, since this research does not have direct bearing upon any war activity, it is believed that it would not be wise to continue it at present.

Another research, on insulating oils and cable saturants, project 74, under way at the Massachusetts Institute of Technology under the immediate supervision of Professor J. C. Balsbaugh, is somewhat newer than project 66 and is now operating on what might be called a production basis. It is recommended that this project be continued at least another year.

The Institute also sponsors jointly with the American Welding Society an extensive welding research program of the Engineering Foundation. This program is so actively supervised by the American Welding Society that the Institute has not undertaken a careful review of it. This does not indicate any lack of interest in electric welding, a science at present so vital to many of our war production activities.

In order that the committee on research may keep in close touch with the technical committees of the Institute and be of service to them when their work indicates that those committees should provide some research program, a research officer, so to speak, has been appointed in each of the technical committees. It is intended that this officer shall be the contact representative between his committee and the committee on research.

Perhaps the one acute problem facing us just now is the production of jewels for meter bearings. This is not definitely an electrical-engineering problem, but jewels for meter bearings are of such great importance to the whole electrical industry that any suggestion leading to the development of a supply of them will be of value.

Should the national situation remind any Institute member of things the committee on research should do, information regarding those recommendations will be welcome and the committee will do its best to turn all promising suggestions into active programs.

COMMITTEE ON SAFETY

The committee has continued its effort to encourage the Student Branches to hold meetings on safety. A circular letter was sent to each Student Branch again at the beginning of the autumn term urging them to hold meetings on safety and suggesting methods of arranging for interesting discussions. Another bulletin was sent at a later date informing them how to borrow two instructive motion-picture films for presentation at meetings on safety. There has been co-operation with the National Safety Council which has conducted a campaign on safety among the colleges.

A survey of the papers published in recent years on electrical safety was undertaken with the result that the committee has in preparation a bibliography of papers and articles on the subject that have been published during the past ten years.

At the suggestion of the committee, there was published in the September 1941 issue of *Electrical Engineering* a paper by G. S. Lawler, entitled "Fires of Electrical Origin in Factories," which had been presented previously at a meeting of the Lynn Section. In this paper, Mr. Lawler emphasized the importance of proper maintenance of electrical apparatus and equipment in prevention of fires and accidents. The committee believes that present war conditions make it more important than ever that electrical installations be maintained in good order.

The committee plans to continue active attention to these and other problems now before it.

Standards

STANDARDS COMMITTEE

While the past AIEE standards year has not been marked by any radically new developments, there was presented to the committee for action a greater-than-normal number of projects. This increase in activity, a continuation of last year's accelerated program, can of course be traced to wartime industrial conditions. The various standards co-ordinating committees and the technical committees of the Institute were equally responsible as the agencies for carrying out this growing program.

Eight projects were approved by the standards committee for publication, as follows:

Standards for Wet Tests, Revised Standards for Measurement of Test Voltages in Dielectric Tests, Revised Standards for Railway Motors, Rating of Electrical Apparatus for Short-Time and Intermittent Duty, Fuses Above 600 Volts, Capacitance Potential Devices, Test Code for D-C Machines, and Test Code for Single-Phase Motors.

The following projects are in various stages of committee development:

Guiding Principles for Selection of Reference and Limiting Values for Standards, Standards for Neutral Grounding Devices, Revised Standard for A-C Power Circuit Breakers, Revised Standard for Lightning Arresters, Revised Report on Standards for Mercury-Arc Rectifiers, Test Code for Impulse Measurements.

The American Standard "Definitions of Electrical Terms," defining over 4,000 electrical and allied terms, is now in the hands of the printer. In furtherance of the desire of the American Standards Association Sectional Committee on definitions to obtain the widest possible distribution for this publication, the AIEE directors authorized a minimum sales price of $1 per copy. This price was made possible only through a quantity production order for 25,000 copies. A national sales campaign is planned, which it is hoped will place not only the entire first edition, but will also require a quantity reprint Individuals and organizations active in the electrical and allied fields are to be asked to cooperate. It is the belief of those who have given much time and thought to the definitions development that only through placement in the hands of all interested individuals can there be obtained a recognition of the real value inherent in the glossary and a justification for the immense number of man-hours spent in its development.

Two other matters of interest also came to a head during the year: the standards manual, and the standards numbering system. The manual was approved in final revised form and it is hoped will prove of great service in explaining the intricacies of standardization procedure and a valuable guide in future activities.

A study of the numbering systems used

by AIEE and ASA showed that it is impractical to select any system that will eliminate all inconsistencies. It also became evident that most of the present difficulties will eventually disappear.

The activities of Institute representatives on ASA sectional committees were continued, and in some cases considerably accelerated because of the war effort. Replacement of representatives was found necessary in a number of cases, largely because of occupational shifts. The organization of a new sectional committee on electric fences is now under way. All international standardization activity as carried on by the International Electrotechnical Commission is at a practical standstill as a result of the war. However, it is planned to push standardization as it affects South and Central America. One step in this direction is the proposed translation of Standards into Spanish and Portuguese.

UNITED STATES NATIONAL COMMITTEE OF THE INTERNATIONAL ELECTROTECHNICAL COMMISSION

The work of the International Electrotechnical Commission, because of the present international situation, has been practically suspended. The central office is being maintained, however, and continues to receive mail at its old address in London, although its valuable records have been moved to a place of safety "for the duration." The United States National Committee of the IEC also is keeping its organization intact and will continue to meet annually so that, as soon as circumstances permit, it will be possible to resume activities.

The USNC at its annual meeting in December 1941 re-elected its officers: E. C. Crittenden, president; L. F. Adams and H. S. Osborne, vice-presidents; Doctor C. H. Sharp, honorary president.

At its annual meeting, the USNC gave further consideration to the desirability of assisting in developing standardization work among the countries of North and South America. As a result of this consideration, the USNC decided to discharge its committee on the subject since the committee's exploration had shown that various other organizations were planning to undertake co-operative work with South American countries and that it seemed best for the USNC to abandon its efforts and to assist where it could the work of other agencies, particularly that of the ASA.

Technical Committees

COMMITTEE ON AUTOMATIC STATIONS

The bibliography on automatic stations covering the period 1932–1940 has been extended to cover 1941, plus a few additional references for 1940, and is now in the hands of the publication committee.

The committee prepared a questionnaire on a-c automatic reclosing equipment applying to stub feeders only. A subcommittee has distributed copies throughout the various Districts, including Canada, and the material collected from this survey will be included in a future report.

A questionnaire on pilot conductors has been received by the relay subcommittee of the committee on protective devices, with which the questionnaire was jointly issued. That subcommittee has issued a preliminary report pertaining to that section of the survey in which it is interested. It is expected that in the near future certain portions of the collected material will be turned over to the committee on automatic stations for classifying the data in which it is interested.

COMMITTEE ON EDUCATION

At the 1941 summer convention, the subcommittee on student guidance reported on its work during the past year. From a questionnaire sent to all the Institute Sections 59 replies were received, of which 20 indicated that those Sections had been carrying on some form of high-school student guidance during the previous year. Of the other 39, 32 stated that they were interested in this kind of work and would welcome suggestions as to how to proceed.

The subcommittee on student guidance was continued for the present year, and an attempt has been made to help those Sections which are interested in carrying on guidance work for the benefit of high-school seniors. The results of this work have not yet come in.

The committee held an informal meeting at the time of the South West District meeting in October 1941, and decided to sponsor an educational session at the winter convention the following January. Three papers were secured and approved for presentation at this convention—one of them for publication in the *Transactions*. The presentation of the papers brought out much interesting discussion.

During the 1942 winter convention, the committee held its annual meeting and discussed the problems of education in the light of the present war emergency. Any move toward the shortening of the academic time spent by students in courses in electrical engineering and any abbreviation of the net content of courses were deplored. The speeding-up of graduation by the elimination of vacations was approved. A resolution to this effect was transmitted to the board of directors, and was approved at the next meeting of the board.

After this meeting, the difficulty of carrying on inspection trips for the benefit of engineering students during the war emergency was discussed and the possibility of showing motion pictures of industrial plants instead was mentioned. A subcommittee on inspection trips was appointed to look into the matter of accumulating information about films that might be secured.

The committee decided to sponsor a discussion session on education at the 1942 summer convention in Chicago, Ill., but to ask for no formal papers on account of the difficulty of getting them written during the war emergency.

For the North Eastern District meeting, the committee approved one paper on the subject of vocational education.

COMMITTEE ON ELECTRICAL MACHINERY

The committee held two meetings during the year, one at the summer convention in Toronto in June 1941, and one at the winter convention in New York in January 1942, at which technical sessions at conventions were discussed and the work of the committee and its subcommittees was reviewed. Plans were made for the 1942 summer convention, to sponsor one symposium on emergency overloading of apparatus and one on mercury-arc rectifiers and their application.

The subcommittee on synchronous machinery has progressed in its work on the revision of the Test Code on Synchronous Machinery and is planning on having the revision prepared and ready for review by June 1942.

The transformer subcommittee continued its co-operation with the ASA committee in the review of the revised ASA Standards on transformers. Papers have been presented and are being prepared for presentation on overloading of transformers for emergency conditions.

The subcommittee on test codes for single-phase motors completed its work on the test code which was submitted to the standards committee. It was issued by the standards committee in November 1941 as the AIEE Proposed Test Code for Single-Phase Motors.

The Test Code for D-C Machines, submitted last year to the standards Committee, was issued by that committee in July 1941.

The subcommittee on rectifiers has, among other things, been studying definitions and a paper was prepared for presentation at the North Eastern District meeting with a view toward unifying terminology. This is of some importance as common practice has not been uniform in terms and meanings in all cases.

The subcommittee on insulation resistance has started work with the object of producing a standard on methods of measuring insulation resistance and a guide for the interpretation of the results obtained.

The committee sponsored one session at the summer convention in 1941 at which five papers on miscellaneous subjects were presented. At the Pacific Coast convention, one paper approved by the committee was presented. At the South West District meeting, one session was sponsored jointly by the committees on electrical machinery and power generation, and several papers on motors were presented. One session on power and machinery and a conference on mercury-arc rectifiers were arranged for the North Eastern District meeting.

COMMITTEE ON ELECTROCHEMISTRY AND ELECTROMETALLURGY

As a result of the pressure of work incident to the war there has been little committee activity during the year. At the meeting held on January 26, 1942, the progress report of the subcommittee on voltage transients in arc-furnace circuits was discussed, and it was voted to continue the study being carried on by the subcommittee. It was requested that any instances of severe transients or short circuits on arc-furnace circuits be reported to N. R. Stansel, subcommittee chairman.

The need for standardization of transformers for electric-arc-furnace operation

was also presented. On motion duly approved, President Prince was requested to appoint a joint subcommittee consisting of representatives of the committee on electrochemistry and electrometallurgy and the transformer section of the committee on electrical machinery to consider the standardization of electric-arc-furnace transformers.

The rapidly increasing demand for electric power by electrothermal and electrochemical plants was discussed. It was pointed out that within the next two to three years these operations will require an additional 20 billion kilowatt-hours per year in the production of aluminum, magnesium, chlorine, stainless steel, and similar war materials.

COMMITTEE ON INSTRUMENTS AND MEASUREMENTS

Two major committee projects were completed. The report on "Telemetering, Supervisory Control, and Associated Circuits," prepared by a joint subcommittee of the committees on automatic stations and on instruments and measurements has been issued in pamphlet form. This encyclopedic report classifies and tabulates the characteristics of the various types of telemetering equipment and should form a useful basis of any future standardization. The report on "Progress in the Art of Metering Electric Energy" prepared by the subcommittee on watt-hour meters was published in serial form in *Electrical Engineering*, beginning with the September 1941 issue and concluding with the December issue. The report is now available in pamphlet form also. It constitutes a complete and authoritative history of the development of the d-c and induction types of watt-hour meters, and includes also a short history of the development of the demand meter.

Technical sessions on instruments and measurements were held at the 1941 summer convention in Toronto and at the 1942 winter convention, at which five, and four papers, respectively, were presented. The committee also sponsored a group of papers stimulated by its subcommittee on dielectric measurements in the field and presented at the session on insulation testing at the 1941 summer convention. The pressure of military work and the confidential nature of new developments probably will seriously curtail the output of technical papers in the immediate future.

In view of the necessity for conserving our energies, a questionnaire was circulated early in the year to stimulate a critical examination of the various standardization activities of the committee. At the fall meeting, it was decided to leave certain lines of work in abeyance and to concentrate on the more pressing problems.

The subcommittee on the revision of AIEE Standard No. 4 has prepared an addition to the table of sphere-gap voltages for 6.25- and 12.5-centimeter spheres which will permit their use up to spacings equal to their diameters. This has been approved by the committee on instruments and measurements and by the standards committee. This subcommittee which is identical in personnel with the corresponding ASA Sectional Committee, remains in readiness for any future standardization in this field.

The subcommittee on definitions has been active in revising certain definitions for the ASA "Dictionary" *C*42 and in securing agreement between these definitions and those used in the "Code for Electricity Meters" and the "Meterman's Handbook."

The subcommittee on current transformers has participated in the revision of section 4 of ASA Standard *C*57 for Transformers, Regulators, and Reactors, in the light of the year's experience with this "Proposed American Standard."

A new subcommittee was appointed to prepare a master code for temperature measurements and has made very good progress.

More recently another subcommittee has been formed to study the report on standards for electrical recording instruments, AIEE No. 40, and to revise it, if necessary, in order that it may be advanced to full standard status.

The committee continues to be represented by liaison members on several other technical committees of the Institute.

COMMITTEE ON MARINE TRANSPORTATION

The activities of this committee have been very greatly curtailed because of war conditions and pressure of work upon all members engaged in shipbuilding and associated industries.

A meeting was held on December 12, 1941. Several changes in Standard No. 45 were approved by the committee, and an addendum issued for the changes approved since the issue of the addenda dated March 20, 1941. The committee has endeavored to keep this Standard up to date to conform to the best practice in shipbuilding. War conditions and scarcity of various materials have necessitated deviation from materials specified therein. The committee decided that such temporary changes should not be incorporated in Standard No. 45. This matter is one that the various manufacturers can best handle to suit their own particular cases.

The subcommittee on wire and cables has been active, and has done considerable work on suggested revisions proposed by the Insulated Power Cable Engineers Association. The purpose of the proposed revisions is to bring the specification for wire and cables in Standard No. 45 more nearly in conformity with the IPCEA standards.

A special subcommittee was appointed to confer with the American Bureau of Shipping on matters relating to the general scope and purpose of Standard No. 45. This matter will require considerable study by the subcommittee before it can be presented to the main committee for consideration. It is doubtful if final action can be taken this year, and it will probably be carried over into the next fiscal year.

COMMITTEE ON POWER TRANSMISSION AND DISTRIBUTION

The committee is now completing the second year of its activities under the new organization with four main subcommittees as follows: substations, transmission, distribution, and general systems. Each subcommittee functions through working groups, the number of which depends on the subject problems coming within its scope.

During the past year, the main committee's activities have been confined largely to sponsoring technical sessions at conventions and reviewing technical papers. The committee sponsored three complete sessions at the winter convention, and likewise is planning three technical sessions at the 1942 summer convention. At the winter convention, one session organized by the committee was devoted to the broad and timely subject, "Distribution Systems in Wartime." Another session was devoted to lightning. One session wholly on cables, and another on lightning, are planned for the summer convention. Other papers sponsored by the committee cover subjects associated directly with the transmission and distribution art, while some cover fields of interest to other committees and are therefore under joint sponsorship.

The proposed revision of Standard No. 41, Insulator Tests, issued in March 1941, is being worked on at the present time with the expectation that it will soon be offered for approval as an AIEE standard. So few comments have so far been received that it is believed this standard can be offered for approval shortly.

The activities of the main committee have been considerably restricted on account of the war conditions; and, as there have not been in evidence problems of immediate concern or importance apparently requiring attention of the committee, the calling of frequent meetings has not seemed justified. Likewise, the work of the subcommittees and working groups has been considerably restricted on account of present wartime conditions. A number of subjects of interest are being considered by these groups, but sufficient progress has not yet been made to report on now.

As many members of the committee are closely associated with problems arising from United States war activities, there has not appeared justification for making heavy demands on the time of these men for committee work which is not mandatory.

COMMITTEE ON PRODUCTION AND APPLICATION OF LIGHT

The committee has continued to keep members of the Institute informed on the latest developments in illuminating engineering, principally through the sponsorship of conferences at District meetings and national conventions and by obtaining articles from qualified authors on illumination subjects for publication in *Electrical Engineering*.

All of these activities have been intensified this year, and plans are now under way to extend them further, especially in those lighting fields which are vital to national defense. A complete report on a conference on civilian-defense lighting held during the 1942 winter convention appeared in *Electrical Engineering* for March 1942, pages 155–6.

A conference on lighting for production is now under consideration for the summer convention in June 1942. Prominent speakers from Canada and the United States will be asked to prepare discussions on this subject which is vital to the defense of each country.

In addition to reviewing all papers on the subject of lighting which are presented for consideration by the technical program committee, and selecting timely lighting subjects and encouraging competent authors to prepare articles for *Electrical Engineering*, this committee also sponsors in *Electrical Engineering* brief summaries and photographs of notable lighting installations.

COMMITTEE ON PROTECTIVE DEVICES

The committee held three meetings during the year and probably will hold another at the 1942 summer convention. Attendance was good, and the discussions dealt mainly with new and revised standards, apparatus insulation levels, temperatures for various types of switchgear, subcommittee reports on subjects under consideration, and papers proposed for technical sessions.

In keeping with the preparedness and war effort, the committee has attempted to bring to completion as rapidly as possible work on the various Standards under its jurisdiction. This appeared very desirable and necessary in order that production during the war period can be based on Standards which reflect proper requirements and present practice. Two new Standards (Nos. 31 and 32) were prepared, approved, and transmitted to the standards committee with recommendation for approval and publication as AIEE Standards. Four Standards (Nos. 19, 22, 27, and 28), which had been issued the previous year for trial use, were completely reviewed and recommended revisions approved. Two other Standards (Nos. 24 and 25) were reviewed. One was recommended to be left unchanged for the time being and work on revision of the other has not been completed.

The major work of the committee was divided among subcommittees: on circuit breakers, switches, and fuses; fault-current limiting devices; lightning arresters; and relays.

The reports of the subcommittees indicate that very substantial progress has been made, especially when it is realized that all members have had unusually large demands on their time for war purposes in connection with their regular work. Consequently, their participation in committee activities, while active and co-operative, have been under somewhat of a handicap.

The following three reports covering a decade of progress in the art were completed and published in *Electrical Engineering:* "Ten Years of Progress in Circuit Interrupters" November 1941; "Ten Years of Progress in Relaying," December 1941; "Ten Years of Progress in Lightning Protection," April 1942.

The committee also has been responsible for the preparation of two extensive bibliographies in its field. One, covering relay literature for the period 1927–39, was prepared by the relay subcommittee and issued as a special Institute publication in July 1941. The second, a comprehensive bibliography on circuit-interrupting devices, including circuit breakers, enclosed switchgear, air switches, bus bars, and fuses, and covering the period 1928–40, is currently in process of publication.

The committee sponsored 13 papers at the 1941 summer convention, 7 at the Pacific Coast convention, 2 at the South West District meeting, one at the Southern District meeting, 19 at the 1942 winter convention, and 1 at the North Eastern District meeting.

The future work of the committee may logically follow along lines of endeavor similar to those of the past. In view of the industry needs, every effort should be made to complete at an early date the proposed standard on distribution-type protector tubes and the revision of Standard No. 25, Fuses Above 600 Volts, as well as the technical report dealing with the subject of selection of neutral-grounding-device impedance.

Awards

COMMITTEE ON AWARD OF INSTITUTE PRIZES

Four national and 11 District prizes were awarded for papers presented during the calendar year 1941 and for the student papers presented during the academic year ending June 30, 1941.

A large number of eligible papers, which were of good quality, were considered, and in determining the awards for the national best paper prizes and the initial paper prize the committee had the benefit of the gradings and recommendations of the technical committees which reviewed the papers. In addition to the four papers awarded national prizes, eight other papers were given honorable mention.

The changes made in the rules on award of "National and District Prizes," issued in the new edition of January 1941, have been in effect for more than an entire year, and have been found to be working satisfactorily.

EDISON MEDAL

The Edison Medal, which is awarded by a committee composed of 24 members of the Institute, was awarded for 1941 to Doctor John Boswell Whitehead, "for his contributions to the field of electrical engineering, his pioneering and development in the field of dielectric research, and his achievements in the advancement of engineering education," and was presented on January 28, 1942, during the winter convention. The medal may be awarded annually for "meritorious achievement in electrical science, electrical engineering, or the electrical arts."

LAMME MEDAL

The Lamme Medal committee awarded the medal for 1941 to Forrest E. Ricketts, vice-president, Consolidated Gas Electric Light and Power Company, Baltimore, Md., "for his contribution to the high reliability of power-supply systems, especially in the design of apparatus for selective relaying and circuit reclosure." Arrangements are being made for the presentation of the medal at the summer convention in Chicago, Ill., June 22–26, 1942. The medal may be awarded annually to a member of the AIEE "who has shown meritorious achievement in the development of electrical apparatus or machinery."

JOHN FRITZ MEDAL

The John Fritz Medal board of award, composed of representatives of the American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, American Society of Mechanical Engineers, and AIEE, awarded the 38th medal (for 1942) to Everett Lee DeGolyer, consulting petroleum engineer, Dallas, Tex., and a past president of AIME, for "pioneer work in the application of geophysical exploration to the search for oil fields."

HOOVER MEDAL

The Hoover Medal was established through a trust fund created by a gift from Conrad N. Lauer, and is to be awarded periodically "to a fellow engineer for distinguished public service" by a board representing the national societies of civil, mining and metallurgical, mechanical, and electrical engineers. The fifth medal, for 1941, was awarded to D. R. Yarnall, cofounder and chief engineer, Yarnall-Waring Company, Chestnut Hill, Pa., a member of ASME and a past president of United Engineering Trustees.

ALFRED NOBLE PRIZE

This prize, established in 1929, consists of a certificate and a cash award from the income from a fund contributed by engineers and others to perpetuate the name and achievements of Alfred Noble, past president of ASCE, and of the Western Society of Engineers. It may be made to a member of any of the co-operating societies, ASCE, AIME, ASME, AIEE, or WSE, for a technical paper of particular merit accepted by the publication committee of any of these societies, provided the author, at the time of such acceptance, is not over 30 years of age. The award for 1940–41 was presented to R. F. Hays, Jr. (A'36), Sperry Gyroscope Company, Garden City, N. Y., for his paper "Development of the Glow Switch" (published in AIEE *Transactions*, volume 60, 1941, May section, pages 223–6).

WASHINGTON AWARD

The Washington Award for 1942 was bestowed upon William Lamont Abbott (F'13) retired chief operating engineer, Commonwealth Edison Company, Chicago, Ill., and a past president of both ASME and WSE, "for advancing the standards of the engineering profession for service to higher education for aiding combustion research," and was presented to him at a dinner on February 26, 1942. This award may be made annually to an

engineer by the commission of award composed of nine representatives of the Western Society of Engineers and two each of ASCE, AIME, ASME, and AIEE.

CHARLES LE GEYT FORTESCUE FELLOWSHIP COMMITTEE

The committee met in March to decide upon the award of the fellowship for the year 1942–43. In view of the very small number of candidates, with a further possibility that any one of them might be called for some form of service with the government, it was decided that no fellowship would be awarded this year. This action is the same as was taken last year for similar reasons.

Joint Activities

UNITED ENGINEERING TRUSTEES, INC.

This organization is the corporate body which holds title in the name of the four Founder Societies to their joint physical properties, namely, the Engineering Societies Building, the Engineering Societies Library, and the endowment funds of the Engineering Foundation. It operates and manages the Engineering Societies Building, and administers certain joint activities of the four Founder Societies.

The building is fully occupied by the Founder Societies and associates. During the year, certain changes were made to improve the services to members of the societies and others, notably improvement in the illumination of the library by the installation of fluorescent lamps, changes in elevator doors on several floors, reconstruction of one floor to provide a greater number of offices, and the change of the electricity supply system from direct to alternating current.

An abstract of the annual report of the corporation for the year which ended September 30, 1941, appeared on pages 56–57 of *Electrical Engineering* for January 1942.

ENGINEERING FOUNDATION

The Engineering Foundation is a joint organization of the national societies of civil, mining and metallurgical, mechanical, and electrical engineers established for "the furtherance of research in science and engineering, and the advancement in any other manner of the profession of engineering and the good of mankind." It assists in a wide range of research projects of interest to science, engineering, industry, and the general public, each project being under the sponsorship of one of the Founder Societies.

Under the sponsorship of the Institute, the Foundation has continued to support the research on stability of impregnated-paper insulation, at the Johns Hopkins University, the research on insulating oils and cable saturants, at the Massachusetts Institute of Technology, and the welding research, the latter under joint sponsorship with the American Welding Society.

A comprehensive abstract of the annual report of the Engineering Foundation for the year which ended September 30, 1941, appeared on pages 57–59 of *Electrical Engineering* for January 1942.

ENGINEERING SOCIETIES LIBRARY

The Engineering Societies Library, which was formed by combining the separate libraries of the four national societies of civil, mining and metallurgical, mechanical, and electrical engineers, and the preparation of a composite card catalog, probably constitutes the best collection of its type in the United States.

On September 30, 1940, the library had 152,263 volumes, 7,755 maps, and 4,492 searches. Books and pamphlets totaling 3,021 were received during the year ending at that time. Current issues of 1,124 periodicals were received. About 20,000 entries were added to the index of periodicals, which now contains over 260,000 cards.

Special services rendered by the library include: photoprints, searches, abstracts, translations, bibliographies, book loans by mail, and others. The library board has been considering means by which members might be more adequately informed regarding the services available.

An abstract of the annual report of the library appeared on pages 59–60 of *Electrical Engineering*, January 1942.

EMPLOYMENT SERVICE

Operating as an incorporated non-profit-making organization, the Engineering Societies Personnel Service, Inc., assists members of the Founder Societies desiring to secure new positions, and conversely assists employers searching for engineers. Nonmembers may receive such assistance when positions available cannot be filled by members.

Offices are operated in New York, N. Y., Detroit, Mich., Chicago, Ill., and San Francisco, Calif., with the co-operation of the Engineering Society of Detroit in that city, the Western Society of Engineers in Chicago, and the Engineers Club of San Francisco in that city.

The service is supported by the joint contributions of the societies and the individuals who secure positions. An analysis of registration and placement records as reported to the national societies is given in table XI.

ENGINEERS' COUNCIL FOR PROFESSIONAL DEVELOPMENT

This Council, organized in 1932 to engage in activities leading toward the enhancement of the professional status of the engineer, includes three representatives of each of the eight participating organizations, which are the national societies of civil, electrical, mechanical, and mining and metallurgical engineers, the Society for the Promotion of Engineering Education, the National Council of State Boards of Engineering Examiners, and the Engineering Institute of Canada. Its principal activities have been carried on by four committees: student selection and guidance, engineering schools, professional training, and professional recognition.

Including the actions on engineering curricula taken on October 30, 1941, the record is:

Total curricula submitted, including reinspections	896
Accredited	460
Accredited provisionally	105
Not accredited	167
Reinspections with no change in status	132
Action pending	6

A comprehensive report on the annual meeting held on October 30, 1941, and a complete list of accredited curricula appeared on pages 606–10 of *Electrical Engineering* for December 1941.

JOINT CONFERENCE COMMITTEE

Upon recommendation of the committee on planning and co-ordination, the board of directors authorized the president and national secretary to join with like officers of the other Founder Societies in an informal conference committee to meet whenever deemed advisable to consider joint efforts in national defense and other matters. The committee met in Indianapolis, Ind., Washington, D. C., Montreal, Que., and Roanoke, Va.

In accordance with its recommendations, the societies organized a joint committee on postwar planning and a joint committee on

Table XI. Analysis of Employment Service

Month	Men Registered					Men Placed				
	New York	Chicago	San Francisco	Detroit	Total	New York	Chicago	San Francisco	Detroit	Total
1941										
May	154	67	86	23	330	61	21	30	12	124
June	193	100	68	79	440	52	20	24	22	118
July	151	84	61	60	356	63	31	26	15	135
August	126	94	76	56	352	41	17	45	15	118
September	144	66	50	43	303	38	15	32	12	97
October	156	84	65	34	339	37	22	16	10	85
November	139	66	46	42	293	37	15	32	10	94
December	115	49	41	28	233	45	18	27	11	101
1942										
January	160	65	58	32	315	41	20	40	12	113
February	148	51	50	37	286	31	29	19	14	93
March	139	60	67	32	298	43	26	34	16	119
April	138	44	49	26	257	49	29	23	10	111
Total	1,763	830	717	492	3,802	538	263	348	159	1,308

inter-American engineering co-operation. It considered various other matters of interest to members of the several societies.

REPRESENTATIVES

In addition to the many divisions of its work represented by its own general and technical committees, the Institute participates in a wide range of activities of interest and importance to engineers and others through its representation upon about 30 joint committees and national organizations.

A list of representatives was published in the September 1941 issue of *Electrical Engineering* and in the 1942 Year Book.

Appreciation

On behalf of the membership, the board of directors expresses its sincere appreciation of the many important contributions to Institute activities made by the national committees and the District, Section, and Branch officers. Despite the extreme difficulties encountered during the past year, and consequent severe restrictions of time available for engineering society activities, enthusiasm for and constructive accomplishment in Institute work have continued at a high level. The continuing keen interest among the members in general has contributed substantially to the accomplishments of the Institute. The board thanks all for their interest and unselfish co-operation.

Respectfully submitted for the board of directors.

H. H. HENLINE
National Secretary

May 22, 1942

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

Property and Restricted Funds Securities, Less Reserve for Securities of Doubtful Value, April 30, 1942

Schedule 1

	Principal Amount of Bonds or Number of Shares of Stock	Restricted Funds				Property Fund (Equipment Replacements)
		Reserve Capital Fund	International Electrical Congress Library Fund	Lamme Medal Fund	Total Restricted Funds	
Railroad Bonds:						
Alleghany Corporation 20 year collateral trust convertible 5%, due 1949	$15,000.00	$ 10,627.50			$ 10,627.50	
Baltimore & Ohio Railroad Company 6% refunding and general mortgage series C, due 1995 (stamped)	12,000.00	8,940.00		$4,330.00	13,270.00	
Chicago & Erie Railroad Company 5% first mortgage, due 1982	1,000.00	1,105.00			1,105.00	
Florida East Coast Railway Company 5% first and refunding mortgage series A, due 1974 (certificates of deposit)	10,000.00*	9,818.75*			9,818.75*	
New York Central Railroad Company 5% refunding and improvement mortgage series C, due 2013	6,000.00	5,742.50			5,742.50	
Northern Pacific Railway Company 6% refunding and improvement mortgage series B, due 2047	10,000.00	10,962.50			10,962.50	
St. Louis-San Francisco Railway Company 5% prior lien mortgage series B, due 1950 (certificates of deposit)	6,000.00*	5,497.50*			5,497.50*	
Western Pacific Railroad Company 5% series A, due 1946 (stamped)	15,000.00*	7,225.00*			7,225.00*	
Total railroad bonds		$ 59,918.75		$4,330.00	$ 64,248.75	
Public Utility Bonds:						
New York & Queens Electric Light & Power Company 3½% first and consolidated mortgage, due 1965	10,000.00	$ 11,000.00			$ 11,000.00	
Bond and Real Estate Mortgage:						
Fidelity Union Title and Mortgage Guaranty Company first mortgage certificates (on property 75–79 Prospect Street, East Orange, N. J.) 4%, due 1944	14,152.05*	$ 13,208.32*			$ 13,208.32*	$943.73*
United States Government Bonds:						
Treasury Savings bonds series D, due July 1, 1949	10,000.00	$ 7,644.00			$ 7,644.00	
Treasury Savings bonds series D, due January 1, 1950	10,000.00	7,500.00			7,500.00	
Treasury bonds 2%, due 1950/48	77,000.00	78,130.94			78,130.94	
Treasury bonds 2½% due 1972/67	6,300.00	1,100.00	$5,200.00		6,300.00	
Defense bonds series F, due June 1, 1953	34,000.00	25,160.00			25,160.00	
Total United States Government bonds		$119,534.94	$5,200.00		$124,734.94	
Capital Stocks:						
American Can Company	60 shares	$ 4,988.40			$ 4,988.40	
American Telephone & Telegraph Company	30 shares	4,897.95			4,897.95	
Commonwealth Edison Company	200 shares	7,580.68			7,580.68	
Eastman Kodak Company	35 shares	4,768.23			4,768.23	
E. I. du Pont de Nemours Company	40 shares	6,398.20			6,398.20	
General Electric Company	130 shares	4,463.80			4,463.80	
International Harvester Company	100 shares	5,030.50			5,030.50	
International Match Realization Co., Ltd. voting trust certificates for capital shares of International Match Corporation	6 shares*	2,094.15*			2,094.15*	
Standard Oil Company of New Jersey	110 shares	4,791.78			4,791.78	
Union Carbide & Carbon Corporation	70 shares	4,858.35			4,858.35	
Total capital stocks		$ 49,872.04			$ 49,872.04	
Total		$253,534.05	$5,200.00	$4,330.00	$263,064.05	$943.73
*Less reserve in full for the securities designated *, considered to be of doubtful value		$ 37,843.72			$ 37,843.72	$943.73
Total Securities, Less Reserve		$215,690.33	$5,200.00	$4,330.00	$225,220.33	

HASKINS & SELLS
CERTIFIED PUBLIC ACCOUNTANTS

22 EAST 40TH STREET
NEW YORK

May 15, 1942

American Institute of Electrical Engineers,
33 West 39th Street, New York.

Dear Sirs:

We have made an examination of your balance sheet as of April 30, 1942, and of your recorded cash receipts and disbursements for the year ended that date. Our examination consisted of a review of the system of internal control and of the accounting procedures of the Institute and examination or tests of its accounting records and other supporting evidence by methods and to the extent we deemed appropriate. We present the following:

Balance Sheet, April 30, 1942 (Exhibit A).
Property and Restricted Funds Securities, Less Reserve for Securities of Doubtful Value (Schedule 1).
Statement of Recorded Cash Receipts and Disbursements of Operating Fund for the Year Ended April 30, 1942 (Exhibit B).
Statement of Recorded Cash Receipts and Disbursements of Property and Restricted Funds for the Year Ended April 30, 1942 (Exhibit C).

In our opinion, the accompanying Exhibit A fairly presents your financial condition at April 30, 1942, and the accompanying Exhibits B and C fairly present your recorded cash receipts and your disbursements of funds, as indicated, for the year ended that date.

Yours truly,

(*Signed*) HASKINS & SELLS

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

Balance Sheet, April 30, 1942

Exhibit A

ASSETS			LIABILITIES		
Property Fund Assets:			**Property Fund Reserves**		$548,510.54
One-fourth interest in physical properties of United Engineering Trustees, Inc.:			**Restricted Fund Reserves:**		
Land, buildings, and equipment (less depreciation and renewal reserve)	$385,367.94		Reserve Capital fund	$251,211.20	
Funded depreciation and renewal reserve	113,080.54		Pension fund	18,000.00	
Total		$498,448.48	Life Membership fund	8,805.91	
Equipment:			International Electrical Congress of St. Louis Library fund	5,358.05	
Library—volumes and fixtures	37,296.37		Lamme Medal fund	4,556.83	
Office furniture and fixtures (less reserve for depreciation, $24,973.05)	9,764.34		Mailloux fund	1,075.85	
Works of art, etc.	3,001.35		Total restricted fund reserves		289,007.84
Investment, less reserve in full $943.73—Schedule 1			**Operating Fund Reserves, Liabilities, Etc.:**		
Total property fund assets		$548,510.54	Accounts payable	$ 13,113.38	
Restricted Fund Assets:			Deferred income:		
Securities—at cost, less reserve, $37,843.72 (quoted market value, $203,652.82), Schedule 1	$225,220.33		Dues received in advance	4,886.98	
Cash (Exhibit C)	63,751.26		Entrance fees and dues advanced by applicants for memberships	659.60	
Accrued interest receivable	36.25		Deferred credits for other unallocated receipts	487.55	
Total restricted fund assets		289,007.84	Subscriptions for *Transactions* received in advance	45.16	
Operating Fund Assets:			Reserve for prepaid subscriptions for *Electrical Engineering*	5,066.74	
Cash (Exhibit B)	$ 16,633.48		Operating fund reserves	26,260.47	
Accounts receivable:			Total operating fund reserves, liabilities, etc.		50,519.88
Members—for dues (less reserve, $8,000.00)	10,861.98				
Advertisers	1,424.03				
Miscellaneous	4,158.44				
Accrued interest receivable	1,812.04				
Inventories:					
Transactions, etc.	1,277.25				
Text and cover paper	6,492.70				
Work in process (May issue of *Electrical Engineering*, etc.)	6,513.99				
Badges	1,345.97				
Total operating fund assets		50,519.88			
Total		$888,038.26	**Total**		$888,038.26

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

Statement of Recorded Cash Receipts and Disbursements of Operating Fund for the Year Ended April 30, 1942

Exhibit B

Cash on Deposit With the National City Bank of New York, May 1, 1941		$ 41,617.90
Receipts:		
Dues (including $96,060.00 allocated to *Electrical Engineering* subscriptions)	$212,948.30	
Advertising	59,619.75	
Transactions subscriptions	6,933.62	
Electrical Engineering subscriptions	9,183.16	
Miscellaneous publications (preprints, Standards, *Transactions* index, etc.)	20,114.89	
Students' fees	13,389.00	
Entrance fees	9,420.85	
Membership badges	2,577.19	
Transfer fees	1,663.04	
Interest and dividends on investments of Restricted Capital fund	7,822.83	
Miscellaneous	16.95	
Total receipts		343,689.58
Total		$385,307.48
Disbursements:		
Publications expense:		
Electrical Engineering	$ 95,951.25	
Transactions	19,805.15	
Year Book	6,988.69	
Miscellaneous publications (preprints, Standards, *Transactions* supplement, etc.)	14,566.26	
Institute meetings	13,759.99	
Institute Sections	37,694.33	
Institute Branches	3,446.66	
Edison Medal committee	188.10	
Finance committee	771.23	
Headquarters committee	193.21	
Membership committee	8,828.86	
Pension fund committee	250.00	
Standards committee (including $1,132.43 for "Definitions of Electrical Terms")	9,867.82	
Technical committees	647.96	
Forward	$212,959.51	$385,307.48
Total (forward)		$385,307.48
Disbursements (forward)	$212,959.51	
Traveling expenses:		
Geographical Districts:		
Executive committees	3,863.21	
Vice-presidents	823.38	
Branch counselors and chairmen	10,844.76	
President's appropriation	1,700.78	
Board of directors	6,516.84	
National nominating committee	1,121.49	
Administrative expenses	50,953.79	
Geographical Districts:		
Initial paper prizes	75.00	
Branch paper prizes	340.50	
Institute prizes, national	215.00	
American Co-ordination Committee on Corrosion	25.00	
American Standards Association	1,500.00	
United Engineering Trustees, Inc.:		
Building assessment	10,984.81	
Library assessment	10,182.56	
Engineering Societies Personnel Service, Inc.	1,210.10	
Engineers' Council for Professional Development	1,275.00	
Engineers Defense Board	166.67	
Engineering Foundation Projects:		
Insulating oils and cable saturants	250.00	
Welding research	250.00	
Research on impregnated paper insulation	250.00	
National Fire Protection Association—Dues	60.00	
Membership badges	2,643.40	
Legal services	250.00	
Transfers:		
To Pension fund	8,000.00	
To Reserve Capital fund	40,160.00	
To Life Membership fund	2,000.00	
Miscellaneous	52.20	
Total disbursements		368,674.00
Cash on Deposit With the National City Bank of New York, April 30, 1942		$ 16,633.48

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

Statement of Recorded Cash Receipts and Disbursements of Property and Restricted Funds for the Year Ended April 30, 1942

Exhibit C

	Restricted Funds							
	Reserve Capital Fund	Life Membership Fund	International Electrical Congress of St. Louis Library Fund	Lamme Medal Fund	Mailloux Fund	Pension Fund	Total Restricted Funds	Property Fund (Equipment Replacements)
Cash on Deposit With the National City Bank of New York and Various Savings Banks, May 1, 1941	$27,095.95	$3,473.34	$5,289.37	$ 24.00	$1,059.87	$10,000.00	$ 46,942.53	$2,738.98
Receipts:								
Interest on bonds and dividends on stock	$ 144.44	$ 52.43	$624.00				$ 820.87	
Interest on bank balance	53.20			$ 15.98			69.18	
Proceeds from sale of securities	$14,103.83	3,134.93				$ 8,000.00	17,238.76	
Transfer from operating fund	40,160.00	2,000.00					50,160.00	
Miscellaneous								$ 0.19
Total receipts	$54,263.83	$5,332.57	$ 52.43	$624.00	$ 15.98	$ 8,000.00	$ 68,288.81	$ 0.19
Total	$81,359.78	$8,805.91	$5,341.80	$648.00	$1,075.85	$18,000.00	$115,231.34	$2,739.17
Disbursements:								
Purchase of securities	$45,838.91		$5,200.00				$ 51,038.91	
Equipment replacements, alterations, and repairs								$2,739.17
Gold and bronze replicas of Lamme medal and certificate				$229.30			229.30	
Transfer to operating fund—reimbursement of prior years' expenses				211.87			211.87	
Total disbursements	$45,838.91		$5,200.00	$441.17			$ 51,480.08	$2,739.17
Balance on Deposit With the National City Bank of New York and Various Savings Banks, April 30, 1942	$35,520.87	$8,805.91	$ 141.80	$206.83	$1,075.85	$18,000.00	$ 63,751.26	

OF CURRENT INTEREST

War-Production Conference, First of Series, Held at Newark, N. J.

At the request of the War Production Board, American engineering societies are holding a series of war-production conferences "to exchange, examine, and disseminate information and experience on the engineering and management aspects of war-production problems, and the change-over of plants and equipment to war production." The first conference was held May 29, 1942, at Newark, N. J.; it was sponsored jointly by the local sections of 14 technical and engineering societies, including the AIEE New York Section, and the New Jersey Council. Approximately 750 attended. Other conferences, sponsored by other local engineering groups, are being held in other sections of the United States. Each conference is being arranged to fit the particular needs of the area in which it is held, and the discussion leaders come from war plants in that area.

Beginning with an afternoon session, which was addressed by five prominent speakers on various phases of war production, the Newark conference included also a dinner which was addressed by AIEE Past President W. H. Harrison, director of production, War Production Board, Washington, D. C., and a group of seven panel meetings in the evening, dealing with as many different aspects of the subjects.

AFTERNOON SESSION

The "general meeting" of the conference at which R. M. Gates, president, Air Pre-Heater Corporation, presided, included the following four addresses:

Introduction to the Problems of Conversion, George T. Trundle, Jr., president, Trundle Engineering Company.

Shop Problems in Ordnance Manufacture, Colonel J. K. Clement, deputy district chief, New York Ordnance District, United States Army.

Shop Problems in Aircraft Manufacture, Lieutenant-Colonel J. A. McDonell, Eastern Procurement District, United States Army Air Force.

Shop Problems in Manufacture of Naval Equipment, Lieutenant-Commander A. S. Kibbee, U.S.N.R., Office of Inspector of Naval Materiel.

In the introductory address of the afternoon, Mr. Trundle urged industry not to build any new tools that it can get along without, but to find ways and means of utilizing old machinery to produce war equipment. He pointed out that for every man in the armed forces there must be 18 in industry and elsewhere. He spoke of a probable requirement of 60,000,000 workers which would necessitate employing older men, women, and younger men of pre-military age. As one way of overcoming the shortage of skilled craftsmen, he recommended breaking down manufacturing operations so as to utilize less skilled workers.

Colonel Clement contrasted the present ordnance-production program against a normal peacetime program, and outlined production-control procedures and the functions of ordnance-production expediters. He also emphasized the need for prime contractors to render all possible assistance to subcontractors, which comprise mostly the smaller manufacturers who are totally unfamiliar with many of the items they might produce on subcontract. He explained how the Ordnance Department had done advance planning for war during the past 20 years, but that the Department had not anticipated the necessity for the United States becoming the "Arsenal of Democracy." He also discussed the problem of developing appropriate cost data for new war products.

In pointing out that a total of 73 trades or crafts are involved in the manufacture of airplanes, Colonel McDonell said that to relieve the present metal shortage plywood is being used in the manufacture of training and cargo ships. This has introduced new problems in the shop. He said that the engine industry had been well prepared for the present emergency but that the production of superchargers, being comparatively new, had imposed new problems. He discussed in some detail the problem of aircraft instrumentation, calling attention to the many different mechanisms represented in the wide variety of such instruments. Jewell bearings for these instruments, which were largely imported before the war, imposed serious problems; these were solved by altering instrument design to reduce the usage and at the same time expanding our own small jewell-bearing industry. Many women have been employed in this expanded instrument production, which introduced new problems. Colonel McDonell also urged all manufacturers of spare parts to work toward the greatest possible accuracy of dimensions, because of the limited facilities for making adjustments in the field.



Commander Kibbee called attention to the wide variety of products required by the Navy by stating at the outset that a battleship in effect comprises a complete community at sea, except that there is no family life; equipment therefore ranges from huge guns to the jeweled bearings of precision instruments. He also urged industry to make full use of old tools. Pointing out that many tools are not being used to full advantage, many others are being used improperly, and still others are idle, he urged that measures be taken to correct this situation. Commander Kibbee emphasized that new machinists—not new machines—are needed, and urged that engineering ingenuity be applied toward adapting old tools to new uses. He expressed the opinion that many of the problems in the present war production arise from the fact that manufacturers have been taken by surprise, but emphasized that the great need is for production—more production—faster.

DINNER PROGRAM

Following the dinner, which was served to a capacity crowd, AIEE Past President W. H. Harrison, director of production, War Production Board, Washington, D. C., spoke on the subject "More War Production Today and Tomorrow." He was introduced by Myron B. Gordon, vice-president and general manager, Wright Aeronautical Corporation, who acted as toastmaster.

Mr. Harrison said that the nation is *doing* its "impossible" job, and that 40 per cent of our national economy is now going into the war effort. He pointed out that present aircraft production is so far in advance of last year's production as to offer no basis of comparison. He said also that ordnance production is at a level three times the highest level during the first world war, and that it is increasing at the rate of about 30 per cent per month. This, he added, reflects the careful planning that has been carried out by our armed forces.

Mr. Harrison pictured the war-production program as a whole as comprising

three stages. The first consists of the provision of production facilities, which is now virtually complete. He expressed the belief that history will record the completion of this stage of the program in such a short time, considering the enormous expansion of production facilities involved, as a monumental accomplishment. The second stage of the program concerns the procurement of materials, and the third stage the procurement of man power. Materials appear to be the limiting factor in the present stage.

Concerning cost, Mr. Harrison said that while some attention is being given to this important factor, it would have to be considered secondary to getting the job done. He emphasized the need for economy of tools, materials, and man power. In this connection he mentioned the high degree of standardization of products manufactured by different companies that is now being achieved.

Expressing his pride at being a member of the engineering profession, Mr. Harrison said in closing: "Never have I seen more unselfish devotion to a job than among the engineers doing the present war job."

PANEL MEETINGS

The seven panel meetings following the dinner covered: ordnance inspection; machine-shop problems; metallurgical problems; substitute materials, chemical equipment, and plant safety; electrical problems; welding problems; and foundry production. M. P. Hooven and H. B. Snow, both of the Public Service Electric and Gas Company, Newark, N. J., served respectively as chairman and secretary of the panel on electrical problems. Discussion leaders and their subjects were:

Electrical Devices as Production Aids, L. F. Stone (M'30), General Electric Company, Newark, N. J.

Plant Rearrangement for Increased Production, E. J. White (M'26), E. J. White Company, Newark, N. J.

Improving Shop Lighting, O. P. Cleaver (A'36), Westinghouse Electric and Manufacturing Company, Bloomfield, N. J.

Power Supply Problems, H. W. Bay, Public Service Electric and Gas Company, Newark, N. J.

Emergency Repairs and Rebuilding Problems, C. E. Eiseman, General Electric Company

Solving Problems in Production of Communication Equipment, H. P. Westman, secretary, Institute of Radio Engineers, New York, N. Y.

Each panel leader spoke briefly on his assigned subject, after which there was a question and answer period featuring an informal general interchange of information on specific current production problems.

The committee on arrangements for the conference was headed by C. A. Hescheles, Brooklyn Union Gas Company, Brooklyn, N. Y. He was assisted by two vice-chairmen: P. T. Onderdonk, War Production Board; and G. J. Nicastro, Combustion Engineering Company. Other members of the committee, which comprised 27 representatives of the various sponsoring societies, included C. C. Whipple, Brooklyn Polytechnic Institute, and M. P. Hooven, Public Service Electric and Gas Company, respectively chairman and secretary of the AIEE New York Section.

Seriousness of Rubber Shortage Portrayed in Joint War-Agency Statement

Four leading war-agency officials recently joined in a statement designed to clarify the facts about the severe rubber shortage. Issued because many confusing and conflicting stories have been circulated about rubber, the statement points out that the shortage is extremely serious, reports to the contrary notwithstanding, and that no rubber of any kind can be spared for purposes not directly connected with the war effort.

Donald M. Nelson, chairman of the War Production Board; Arthur B. Newhall, Rubber Co-ordinator; Joseph B. Eastman, director of the Office of Defense Transportation; and Leon Henderson, Administrator of the Office of Price Administration and director of the WPB Division of Civilian Supply, all joined in the statement. As rubber is one of the scarce materials used widely in electric circuits and equipment, the statement may be of interest to many readers of *Electrical Engineering;* accordingly, the essential substance follows.

"There has been a great deal of confusion about the rubber situation, much of it caused by optimistic stories about the availability of synthetic rubber at an early date, or the large amount of scrap rubber that can be reprocessed. But there is little real basis for such optimism. Our rubber shortage is one of the worst materials shortages we face. We can spare no rubber of any kind for nonessential uses. Statements to the contrary are misleading, and do the country a great disservice, for the facts as we see them are grim, and we need 100 per cent co-operation in conservation measures by the general public and by industry.

"Before Pearl Harbor, it appeared that this country had an adequate supply of rubber, in the light of the situation as it then existed. We had stock-piled substantial tonnages in anticipation of interruption in shipments from the Far East, and steps had already been taken to regulate civilian consumption.

"Events following Pearl Harbor, however, created a wholly new series of problems. The President announced a new military program on January 6. This very greatly increased our military requirements for rubber. Then, our major sources of rubber supply were lost. In addition, our Allies were forced to look to the United States as a source of military rubber.

"Thus, despite precautionary steps taken in 1941, it has become necessary to develop a rationing program for rubber which eliminates all but the most necessary uses. War Production Board figures show three facts:

"1. We cannot spare any rubber to make new tires for ordinary passenger cars; the tires we do have must be strictly rationed to essential uses.

"2. All the synthetic rubber we get must go to the war effort.

"3. The most optimistic estimates for this year and next indicate no rubber for anything but the most essential uses.

"Actually, the rubber shortage is far worse than most people seem to realize; the enemy controls 90 per cent of the world's rubber-producing areas, and every ounce of our stock pile is needed desperately for the armed forces. Worst of all, the optimistic stories may keep us from recognizing what we are up against until too late. Our biggest stock pile of rubber is on our cars; these tires must be preserved. Autos shelved for the duration for lack of tires put more burden on already overcrowded busses and trolleys.

"Every citizen can and must adopt a five-point conservation program:

"1. Stop driving your car except when necessary; make it last.

"2. Drive under 40 miles an hour.

"3. Shift tires from wheel to wheel and inflate them properly.

"4. If you drive to work, drive your friends and neighbors; car-pooling is essential.

"5. Remember that rubber is precious; save it; every car is now a vital part of the nation's transportation system.

"Needless driving today is unpatriotic. Deliberate waste of rubber helps the enemy. We call on Americans to ration themselves strictly.

BACKGROUND

"This is the situation that faces us. The amount of rubber that can be made available for civilian, industrial, and essential transportation purposes this year must be held down to not more than 150,000 tons, which is 79 per cent less than the 700,000 tons consumed for all civilian purposes in 1941. The actual current rate of use—10,000 tons a month—is 83 per cent less than the 1941 rate of civilian consumption.

"The 1942 allotments do not include any rubber for new passenger-car tires, and are restricted to articles essential to the civilian industrial economy, such as bus and truck tires, and certain industrial, medical, and health items.

"It has been reported that some drivers are not taking conservation measures seriously, in the belief that eventually their tires will be requisitioned. But if we wear out the tires on the 30 million passenger cars, the truck, bus, and train transportation systems of the nation will be swamped. On the other hand, if it is possible to preserve cars in the hands of their owners, it will be an advantage to all transportation and to the war effort. If the time should come when the Government had to call on civilians to sacrifice their tires, we know they would respond patriotically. In the meantime, no American should deliberately waste the mileage left in his tires.

"Detailed estimates of our requirements and supplies, for military reasons, cannot be made public. But we have the figures, and the story they tell is a very serious one.

In spite of the excellent job the Army and Navy have done in rearranging specifications to reduce the rubber consumption of military articles, our war machine still eats up huge amounts of rubber.

"It has been necessary, therefore, for the rubber and rubber products branch of the War Production Board to curtail drastically the rubber permitted for civilian articles, and to establish new specifications to reduce the rubber content in essential articles. In addition, the Office of Price Administration has instituted a rationing program for tires, the armed services have adopted conservation regulations, and the Office of Defense Transportation has issued drastic regulations directed toward elimination by commercial operators of waste and unnecessary mileage.

"The following figures show how the war effort demands rubber that must be made available: A medium tank requires 1,750 pounds; a gas mask, 1.8 pounds; a ten-ton pontoon bridge, 3,200 pounds; a half-ton truck, 125 pounds; a Flying Fortress, 1,250 pounds; the pneumatic rafts carried by airplanes, 29 pounds each. So it goes. Rubber is indispensable. We do not usually connect rubber with a ship, but a 35,000-ton battleship alone requires 150,000 pounds—or enough to equip 2,000 passenger automobiles complete with spare tires.

SYNTHETIC RUBBER

"The War Production Board is making every effort to expand the production of synthetic rubber, and is investigating every possible new process, but all the information we have shows that every pound of synthetic rubber which this country will be producing at forced draft between now and the end of 1943 must be reserved for direct and indirect military purposes. None can be made available for the manufacture of tires for nonessential civilian purposes.

"The War Production Board has set a goal of 800,000 tons as the production *rate* to be reached by the end of 1943. Of this, production of Buna S, a butadiene type synthetic is to reach a *rate* of 700,000 tons by the end of 1943. The balance is made up of butyl and Neoprene. But reaching a *rate* of 700,000 tons, of course, is a much simpler thing than actually producing that much rubber in a year.

"The present program calls for production of over 300,000 tons during the calendar year of 1943. In addition the Rubber Co-ordinator's office is studying the possibility of increasing the currently planned production of synthetic rubbers other than the Buna S; but many difficulties remain to be solved.

RUBBER SALVAGE

"All old scrap rubber can be reclaimed and used over again. Reclaimed rubber can be mixed with crude rubber to form a compound usable in many products, military as well as civilian. But we cannot process rubber that is in the basements or back yards or garages of the country. Old tires, tubes, rubber shoes, hose, bathing caps, and other articles must be turned in, in ever increasing quantities, if we are to maintain the capacity of reclaiming plants.

"Since Pearl Harbor, the flow of scrap rubber to reclaiming plants has greatly diminished. It must be started again. Every American must see to it that every ounce of old rubber he owns gets into war channels. Scrap rubber can be sold to junk dealers or can be given to charitable organizations. This is a tangible contribution that the American people can make to the war effort. Refusal to do so is hoarding at the expense of our armed forces.

GUAYULE

"The wild guayule shrub has been producing rubber for years in Mexico, and a small amount of cultivated guayule has been growing in the United States.

"A recent Act of Congress provided for the planting of 75,000 acres of guayule in the Western Hemisphere. Pursuant to this act, all available guayule seeds in the United States have been planted, and from these seedlings will come not only a harvest of rubber-bearing shrubs, but more seeds to increase the plantings. However, it will take four to six years to grow enough guayule rubber to make an appreciable contribution to the supply.

"Not more than 10,000 tons annually can be expected soon from Mexican guayule.

SOUTH AMERICA

"Negotiations are in progress with all Latin American countries, and agreements have recently been made with Brazil, Peru, and Nicaragua in which the United States will take the entire exportable surpluses of their rubber for the next five years. This will meet only a small part of our needs. Brazil will be able to ship this country from 10,000 to 15,000 tons of crude rubber this year, and, we hope, perhaps 25,000 to 30,000 tons in 1943. The Peruvian agreement is expected to provide between 6,000 and 10,000 tons over the five-year period.

"In 1912, Brazil produced over 40,000 tons of rubber. In recent years, however, the industry has deteriorated, and it will take considerable time to revive it. Most of the trees grow wild in the jungle, far from transportation facilities, and points of concentration are few and far between."

Resources Protection Board Established

A Resources Protection Board which will evaluate the relative wartime importance of all industrial plants, war installations, facilities, and vital economic resources and make recommendations for their protection was named recently by Donald M. Nelson, chairman of the War Production Board. William K. Frank of the production division of WPB was appointed to act as chairman of the new organization.

The Resources Protection Board will cooperate closely with the Army and Navy, the Maritime Commission, and Office of Civilian Defense in furnishing ratings and recommendations by which they may be guided in planning the protection of resources. It will make an over-all study of the relative importance to the war effort of all plants and installations, including factories, shipyards, railroads, communication networks, and mines and other natural resources. The hazards that will be considered will include bombing, sabotage, espionage, or actual invasion, as well as natural hazards such as fire and flood.

For over a year the Army, Navy and other agencies have been putting into effect protective measures. The new board will act as a co-ordinating agency to assure that no important resource or facility has been overlooked.

Goal of $12,000,000,000 Set for War Bonds in 1942–43

A letter signed by Secretary of the Treasury Henry Morgenthau, Jr., recently was circulated to thousands of business firms in the United States, pointing out clearly and frankly the situation the country faces in financing the war and describing a definite goal of war savings for everyone. *Electrical Engineering* has been asked to bring the contents of this letter to the attention of its readers; accordingly, the principal portion of the letter follows.

"Since the Defense Savings Program was launched in May 1941, events of far-reaching importance have occurred. To preserve our very existence we have been compelled to wage war upon far-flung battle lines. To maintain these lines, the President has said that during 1942 we must produce over 60,000 planes; 45,000 tanks; 20,000 antiaircraft guns; 8,000,000 tons of shipping; in addition to mobilizing, training, and equipping millions of fighting men. Upwards of 50 per cent of our total productive capacity and an equal share of our national income must be diverted to making war materials.

"This has meant a tremendous increase in the magnitude of the financial problem facing the Government. Reliable estimates indicate that during the next fiscal year (July 1, 1942 to June 30, 1943) we shall spend in the neighborhood of $60,000,000,000.

"The Revenue Act as it comes from Congress will determine how much of the money needed to finance the war is to be raised by taxation. The balance must be borrowed by the Treasury. In all probability, we shall have to borrow upwards of $35,000,000,000 between now and this time next year.

"If the Government is compelled to go to the commercial banks for the bulk of these funds, the result will be to increase inflationary tendencies which are already serious. This is true because when commercial banks buy Government bonds they do not pay for them with actual cash taken from their vaults, but by placing on their

books newly created deposits to the credit of the Government. When the Government draws upon these deposits to pay for the goods and services it buys, the purchasing power of those to whom these payments are made is increased without any decrease in the purchasing power of those from whom the money is borrowed.

"When bonds are purchased with savings out of current income, on the other hand, such savings help to reduce excess consumer income which if spent for a limited supply of consumer goods would tend to force prices up. It is for this reason, among others, that we are going directly to the people for as much as possible of the money needed for the war.

"It would be difficult to say exactly how much we can borrow directly from the people. We cannot, of course, hope to borrow in this way all that will be needed. Nevertheless, some definite objective is desirable if we are to have a standard by which to measure our success.

"We have, therefore, set as our goal for the twelve month period beginning July 1, the sale of United States Savings Bonds, Series *E*, *F*, and *G*, having an initial cost value of not less than $12,000,000,000. This will be equal to slightly more than 10 per cent of our estimated national income during this period.

"Sales of Defense Bonds during the period from May 1941 through March 1942 amounted to $4,860,000,000, or an average of approximately $440,000,000 per month. If we are to reach our goal—an average of a billion dollars a month—we shall have to increase this rate of sale by approximately 2½ times. This should not be difficult to do in view of the rapidly increasing national income and in view also of the fact that the supply of many commodities upon which people would normally spend their income will be restricted by the demands of war production.

"The seeing of a definite goal or quota does not mean an abandonment or basic change in our fundamental objectives and methods. It does mean an intensification of activity all along the line. It does mean that henceforth our savings campaign must move on a war basis. If we are to achieve the goal outlined for the nation as a whole, it will be necessary to establish subsidiary goals or quotas for states and counties. This we intend to do.

"The most effective, single method for promoting the systematic purchase of United States Saving Bonds is through the payroll savings plan. Already nearly 50,000 firms in the United States employing a total of almost 20,000,000 people have made such plans available to their employees.

TIME IS SHORT

"The ever increasing demands of our war machine create an urgency that we cannot escape or evade. To raise the billions we now need to win the war, and to do all in our power to check inflation, we must raise our sights. I am suggesting, therefore, as a total or quota for those administering the payroll savings plan, that at least 10 per cent of gross payroll be set aside by the employees for the purchase of United States Savings Bonds.

"We are still a long way from that goal. Among the nearly 50,000 firms having a payroll savings plan the average participation at the present time is about 45 per cent of the employees. The average monthly saving is about $7.50 per capita, representing in the neighborhood of 4.8 per cent of the pay of those participating. In other words, if we consider *all* of the employees of all the participating firms, only a bit more than 2 per cent of the gross payroll is now being invested in Defense Bonds.

"Considering the difficulties involved in the initial installation of payroll savings plans this is a good record. But we must go forward now on two fronts: First, we must increase the percentage of employees participating in payroll savings plans from approximately 45 per cent to at least 90 per cent of the total number. Second, we must encourage all participating employees to increase their average monthly allotment from about $7.50 per capita to an average of nearly $20 per capita."

EDUCATION • • •

Technological Institute Dedicated at Northwestern University

Dedication ceremonies for the newly completed $5,000,000 building of the Technological Institute of Northwestern University, Evanston, Ill., were held June 15–16, 1942. In addition to the dedicatory convocation on the afternoon of June 16, the program included three conference sessions, inspection tours, a dinner, and a reception. Distinguished representatives of government, education, and industry addressed the various sessions.

Sculpture and stonework around the main entrance of the building of Northwestern Technological Institute, Evanston, Ill., depict symbolically the background of technology. Over the left doorway Archimedes demonstrates the lever principle; over the right, Lavoisier studies combustion.



The electrical machinery laboratory, one of 20 laboratories in the electrical-engineering wing of Northwestern Technological Institute, contains a-c and d-c equipment and accessories.



Future Meetings of Other Societies

American Institute of Mining and Metallurgical Engineers. Regional meeting, October 12–17, 1942, Los Angeles, Calif.; joint meeting, coal division, AIME, and fuel division, ASME, October 1–2, 1942, St. Louis, Mo.

American Physical Society. 250th meeting, July 11, 1942, Berkeley, Calif.

American Welding Society. 23d annual meeting, October 12–15, 1942, Detroit, Mich.

Association of Iron and Steel Engineers. Annual convention, September 22–24, 1942, Pittsburgh, Pa.

Founded in 1939 by the gift of Walter P. Murphy, chairman, Standard Railway Equipment Manufacturing Company, the Technological Institute is headed by Ovid W. Eshbach (F'37) as dean. Its curriculum consists of four major departments, civil, mechanical, chemical, and electrical engineering, and is conducted on the co-operative plan developed by the late Dean Herman Schneider of the University of Cincinnati, under which students alternate periods of study of work in industry.

The new building of the Technological Institute, which houses all departments, is 500 feet wide and 342 feet deep, containing about 10 acres of floor space. It consists of a central structure containing the main auditorium, lecture rooms, library, student lounge, and main offices; and six wings, housing the four engineering departments of the Institute and the departments of physics and chemistry of the College of Liberal Arts.

Speakers at the dedication ceremonies included Director Donald M. Nelson, and Lieutenant General W. S. Knudsen of the War Production Board; Secretary of Commerce Jesse H. Jones; Raymond Walters, president, University of Cincinnati; Karl T. Compton (F'31) president, Massachusetts Institute of Technology; Martin W. Clement, president, Pennsylvania Railroad; Alex D. Bailey, chief operating engineer, Commonwealth Edison Company; Charles F. Kettering (F'14) president, General Motors Research Corporation; W. F. G. Swann, director, Bartol Research Foundation; George O. Curme, Jr., vice-president, Carbide and Carbon Chemical Corporation. Also participating in the ceremonies were Governor Dwight H. Green of Illinois; Alfred H. White, president, Society for Promotion of Engineering Education; Roger Adams, chairman of the department of chemistry, University of Illinois; Henry T. Heald, president, Illinois Institute of Technology; Robert C. Disque, acting president, Drexel Institute of Technology; Captain Frank Lash, Chaplain Corps, United States Navy; the Reverend Ernest F. Tittle, Evanston, Ill., as well as Franklyn Snyder, president of Northwestern University; Kenneth F. Burgess, president of the University's board of trustees; Dean Eshbach; and Walter J. Cummings, chairman of the board, Continental Illinois National Bank and Trust Company, who headed the dedicatory committee.

LETTERS TO THE EDITOR

INSTITUTE members and subscribers are invited to contribute to these columns expressions of opinion dealing with published articles, technical papers, or other subjects of general professional interest. While endeavoring to publish as many letters as possible, Electrical Engineering reserves the right to publish them in whole or in part or to reject them entirely. Statements in letters are expressly understood to be made by the writers; publication here in no wise constitutes endorsement or recognition by the AIEE. All letters submitted for publication should be typewritten, double-spaced, not carbon copies. Any illustrations should be submitted in duplicate, one copy an inked drawing without lettering, the other lettered. Captions should be supplied for all illustrations.

A Peace Worth Fighting For

To the Editor:

President William E. Wickenden's address on "A Peace Worth Fighting For" (*EE, Mar. '42, p. 113–19*) is a most excellent and eloquent analysis of the economic problems that will confront the United States at the conclusion of the present world-wide social and economic cataclysm. That the conditions to be faced by the peoples now at war will try men's souls is self-evident. A realist might legitimately conclude that social and economic chaos will be the inevitable lot of the human race after, not the revolution, but the devolution of its spiritual and social values now taking place.

I can wholeheartedly agree with Doctor Wickenden in his contention that in production alone will rest the economic salvation of the world; and that, unless the United States too is prostrate, it must contribute to the reconstruction and regeneration of the countries devastated by war. But the inevitable economic prostration of most if not all of the world is not the only problem that will have to be solved. Other problems of even greater significance and influence will confront the statesmen, humanitarians, and all the peoples in whom there will still remain a slight spark of the spirit of the lowly Nazarene.

If I read Doctor Wickenden's thesis aright, his conclusions are based on the assumption that the failure of the United States to join the League of Nations, the "flood of destructive nationalism," and economic dislocations are the major causes of this war.

That these factors are, if not the real causes, the alleged causes no one will deny. But there are other and more basic causes that are seldom mentioned. But before discussing these, I would like to point out briefly that the League was planned for a democratic world. When the member nations ceased to be democracies the League had to die.[1] No nation could be compelled to be a democracy against its will, and hence the League, with or without the membership of the United States, was bound to be ineffective. The current assumption that our membership would have given vitality to the League is a mere allegation without any supporting evidence. Lord Kemsley does not ascribe the war to the failure of the League but to President Wilson's 14 points. His exact words are: "Who was responsible for the drawing up of the 14 points which ultimately brought about the second great war?"

No engineer should quarrel with the spirit of nationalism. If the Versailles treaty "let loose a flood of nationalism," that spirit was a reality pressing for release. This spirit of nationalism was most strongly manifest by the small nations for they were the most cruelly oppressed. But none of these can be held responsible for the present holocaust. In short, the spirit of nationalism is a reality as much as the resistance of a conductor, and it can be neither exorcised nor suppressed. It must, therefore, be an important consideration in any future treaty of peace.

The more basic cause of the war mentioned above is the decay of the integrity of human beings and of their governments. 'Tis true that faith is the basis of civilization and in fact, of all human relations, but when that faith is destroyed reversion to barbarism and chaos is inevitable. Doctor Wickenden says we must have faith, and then asks, "faith in what?" Yes, faith in what! The maintenance of faith in our ability to weather the oncoming economic storm is easy in comparison with its restoration in the promises and pledged words of the Axis powers and their peoples. The present attack is not merely on the economic stability of the country, but upon its moral stability. It is the restoration and preservation of faith in moral values "that will try men's souls." A reincarnation of the forces of evil is, Samson-like, destroying the temple of civilization.

During the past 80 years Germany has initiated, or been principally responsible for five wars; against Denmark and Austria in the 1860's, against France in 1870, the war of 1914, and the present war.[2] The fundamental causes of all these wars were not economic but psychological. The psychological factors as they apply to the present war may be summed up in the words of Raoul De Roussy De Sales as follows:

"The combination of German military dogmatism and of the fanatical exaltation of the Nazi whirling dervishes is the overwhelming force which dominates the German soul today. The outside world must realize that, under such a regime, it matters very little whether Fritz and Hans are kind, humane, appreciative of the higher values of life, and in general civilized. All these tendencies are combated by the surroundings in which they live. The highest entity in which they are asked to believe and to which they belong, the German *Volk*, is presented to them as a negation of these values, as a great force

of destruction." And further he says: "The removal of Hitler might plunge Germany into chaos. It might end the war. It would not solve the German problem, because the roots of Hitlerism go far deeper than the immediate events which seem to have given it birth. Hitler is merely an accident in the evolution of Germany."[3]

The purpose of this war is not to give equal and like economic opportunities to all the peoples of the earth. Such an achievement is beyond the ability and power of any nation or combination of nations. The real objective is to quell a Germanic revolt against 2,000 years of civilization. That objective transcends all other forms of "peace worth fighting for" and its achievement will be most difficult. Nevertheless, it is the objective for which the people will dedicate and sacrifice their all.

Military victory will not of itself solve the problem of German revolt against the world. That solution can only come through the transformation of the German outlook on all the essential questions that for so many centuries have faced humanity. Before a permanent peace can be maintained, Germany must surrender its belief in the theory of racial superiority, and of the divine right of the German *Volk* to rule all other people. It must not continue as a chronic rebel in a democratic world, for if it does, the world will cease to be democratic and become militaristic.

REFERENCES

1. Democracy Today and Tomorrow, **Eduard Benes.**

2. Failure of a Mission, **Nevile Henderson.**

3. What Makes a German, **Raoul De Roussy De Sales.** *The Atlantic Monthly*, March 1942.

C. M. JANSKY (F'32)

(Professor emeritus of electrical engineering, University of Wisconsin, Madison)

An Analytic Approach to the Hysteresis Loop

To the Editor:

In the solution of most electrical engineering problems having to do with machine and transformer operation, it is essential to take into account the saturation of the iron circuit over the complete cycle of current and voltage. Solutions to this nonlinear problem have always been approximations, which, it must be granted, have been very faithful as to the actual performance of the apparatus.

The differential analyzer in the Moore School of Electrical Engineering at the University of Pennsylvania, Philadelphia, is often employed in the solution of such problems. When so used the accepted practice has been to omit the hysteresis effect of the iron and to consider only the normal magnetization curve as shown in Figure 1.

A somewhat unusual method for an approximation to the complete hysteresis loop may be arrived at through the use of the error function. So far as the authors know, no papers have been published in which this approximation was made. Under the proposed method, the hysteresis loop may be considered to be symmetrical about the normal magnetization curve. This would mean that one side of the loop is like the other except for a horizontal shift along the axis. The true curve, on the other hand, not only is shifted, but also is turned through 180 degrees about the X axis.

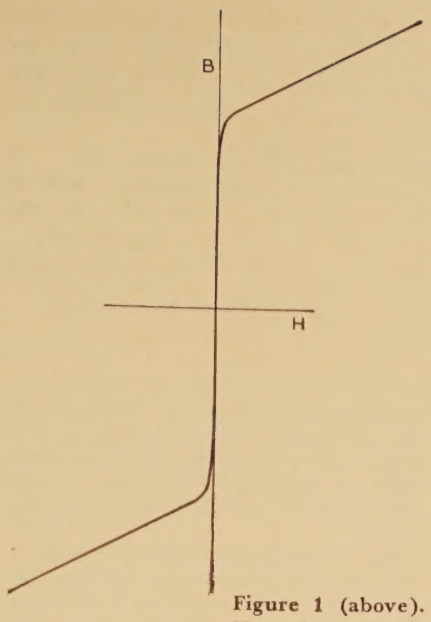


Figure 1 (above). Normal magnetization curve of sample of iron used in current relays

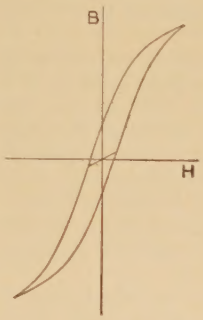


Figure 2 (left). Hysteresis loop as drawn by the differential analyzer. This is a solution of equation 2

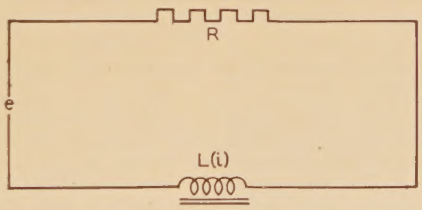


Figure 3 (above). Simple R–L circuit given by equation 4

The hysteresis loop was approximated by the expression

$$B = B_s \operatorname{erf} \frac{H \pm H_c}{H_c} \qquad (1)$$

where

B_s = saturation value of flux density

H_c = coercive force

The sign of the H_c in equation 1 is plus when H is decreasing, and minus when H is increasing. For various kinds of iron H_c will vary. The introduction of H_c and the variation of H_c for various kinds of iron are taken care of on the differential analyzer through the use of a "dead-band" unit.

The dead-band unit is a device for the mechanical coupling of two linear shafts, one considered the driving shaft and the other the driven shaft. When the unit is inoperative, the driving shaft and the driven shaft act as a single coupled shaft. When the driving shaft starts to reverse, however, the driven shaft remains motionless for a preset number of turns of the driving shaft, at which time the two shafts again couple and act as a single shaft. In this particular case the driving shaft is H. The dead-band unit is set so that the driven shaft is still for H_c turns of the driving shaft. The output of the unit is then $H \pm H_c$, the quantity used in the error function.

Through an appropriate substitution of variables, it can be shown that the relation between B and H of equation 1 reduces to

$$-\frac{2}{H_2}\int (H \pm H_c)\,dB = \frac{dB}{dH} \qquad (2)$$

Equation 2 is in a form which the differ-

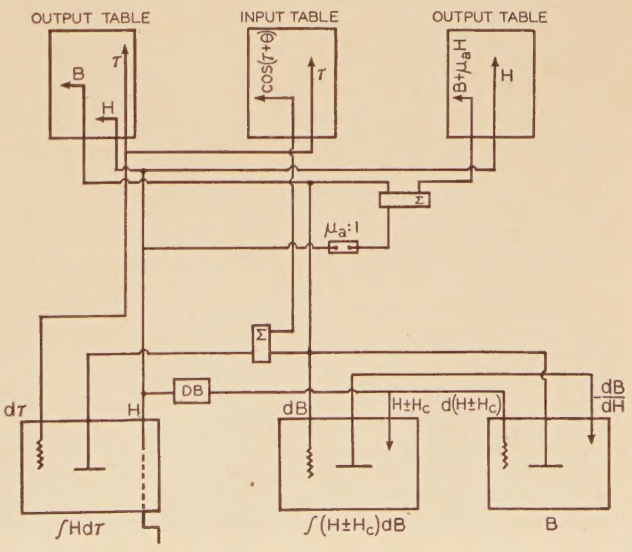


Figure 4 (right). Set up of differential analyzer for the solution of the nonlinear circuit shown in Figure 3, after the equation has been transformed to that given by equation 5

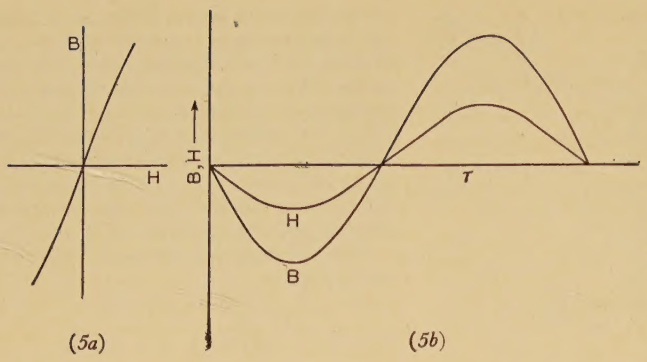


Figure 5a. Hysteresis loop for $H_c = 0$ (no hysteresis)

Figure 5b. B versus τ and H versus τ for the case $H_c = 0$

ential analyzer can solve. A typical curve of B versus H is shown in Figure 2, which, it must be admitted, is not a bad first approximation to the actual curve. In order to take care of the tilt of the hysteresis loop a linear term of the form $\mu_a H$ was added to the flux density when the loop was plotted. Here μ_a is the permeability of air. The plotted curve shown in Figure 2 is then of the form

$$B = B_s \operatorname{erf} \frac{H \pm H_c}{H_c} + \mu_a H \qquad (3)$$

As an application of this method, solutions were obtained for the nonlinear circuit containing resistance and a saturable inductor (Figure 3). The equation to be solved here is

$$R_t + 10^{-8} A \frac{dB}{dt} = E \sin \omega t \qquad (4)$$

Upon a change of variable, this equation becomes

$$\int H_d \tau + B = \cos(\tau + \theta) \qquad (5)$$

To solve this equation, considering the nonlinearity introduced by the B–H loop, the analyzer was set up as shown in Figure 4. The H shaft was turned by an operator in such a way as to maintain the relationship defined by equation 5. Typical results using various sets of parameters are shown in Figures 5, 6, and 7. Here B and H are plotted as functions of time τ, as well as a function of one another to produce the hysteresis loop. From the relationship between the magnetizing force and the current, the latter may be obtained from the curves.

Figure 5 is the case for $H_c = 0$. This corresponds to no hysteresis, and it is seen that since saturation was not reached, the B and H curves are sinusoidal in form. A steady state of operation is reached after a few cycles.

Figure 6 shows the case for another set of parameters, with dead band equal to 31.8 units, and H_c equal to 3.98 units on the plotted curve. Again the B and H curves are plotted as functions of time, and are almost sinusoidal, with the H curve showing some tendency toward a third harmonic. The curves labeled H_2 and B_2 are simply continuations along the time axis of curves H_1 and B_1.

Figure 7 is the case for an initial value of $dB/dH = 15$, with the applied voltage equal to one half the previous values. Here again the H curves show a definite tendency toward a harmonic, with a similar tendency appearing in the B. The meanings of H_2 and B_2 are the same as mentioned previously.

Although the results of this preliminary investigation show a possibility of the use of the differential analyzer for the plotting of B–H curves and their use in nonlinear problems, there still remains the problem of correlating the machine results with an actual sample of iron; that is, correlating the scale factors of the machine with the actual numerical values of B and H.

C. N. WEYGANDT (A'37) and S. CHARP

(Respectively assistant professor of electrical engineering and research assistant in electrical engineering, Moore School of Electrical Engineering, University of Pennsylvania, Philadelphia, Pa.)

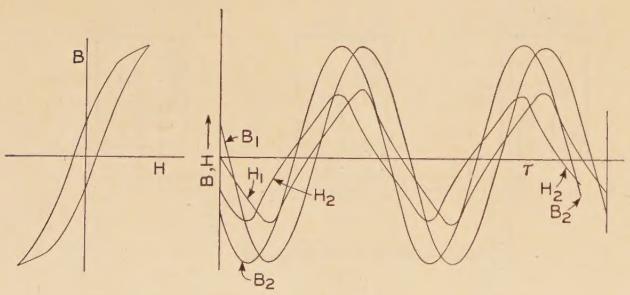


Figure 6a. Hysteresis loop for $H_c = 3.98$, "dead band" DB = 31.8 units

Figure 6b. B versus τ, H versus τ for $H_c = 3.98$, DB = 31.8 units

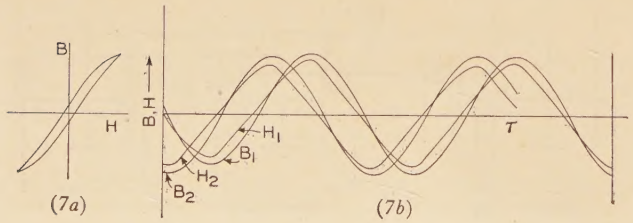


Figure 7a. Hysteresis loop for dB/dH = 15, but applied voltage is one half that for Figure 6

Figure 7b. B versus τ, H versus τ for same conditions

Use of Loud-Speaker Fields As Filter Chokes

To the Editor:

Since the use of loud-speaker fields as filter chokes is so common in radio these days, certain limitations to this system of field excitation should be pointed out. As is generally known, it is necessary to supply a "hum-bucking" coil in series with the voice coil to eliminate induced hum in the cone motion of the loud-speaker. It is not generally known, however, that this practice introduces relatively large amounts of distortion.

Let us consider the equation of motion of a loud-speaker. For the purpose of analysis, we shall neglect the inductance and the resistance of the voice-coil winding by considering what happens on the application of a given amount of current to this winding. Then the equation of motion is

$$I \frac{d^2x}{dt^2} + R \frac{dx}{dt} + kx = CBi$$

where

I is the inertia of the cone
x is the displacement of the cone
R is the frictional coefficient of the cone
k is the elastic constant of the cone
C is an arbitrary constant
B is the field flux density
i is the current in the voice coil

For the present discussion, we need consider only the right-hand half of the equation, namely CBi. We know that the frequencies of forced vibration are determined here, whereas the transient solutions are determined by equating the left-hand side to zero. Hence we wish to find out the frequencies of vibration established by the right-hand side. Let us take the flux B as of the following form:

$$B = B_0 + B_1 \sin 2\kappa\mu t + B_2 \sin 4\kappa\mu t + \ldots$$

The second, third, etc., terms on the right are the terms which the choke is attempting to eliminate. Let us take

$$i = i_0 \sin 2\kappa\omega t$$

Then we find that CBi takes the form

$$C[B_0 + B_1 \sin 2\kappa\mu t + \ldots] i_0 \sin 2\kappa\omega t$$

This reduces to the form

$$CB_0 i_0 \sin 2\kappa\omega t + CB_1 i_0 \sin 2\kappa\mu t \sin 2\kappa\omega t + \ldots$$

The second term of this reduces to the form

$$\tfrac{1}{2}[\cos 2\kappa(\omega - \mu)t - \cos 2\kappa(\omega + \mu)t]$$

Hence, we notice that a ripple of magnitude B_1 will cause cross products of a magnitude $^1/_2B_1$. The hum-bucking coil eliminates the induced hum, but since it does not eliminate the variation in B, it does not remove the cross products. The total percentage of first order cross products will be $100B_1/B_0$. These cross products are very easily noticed in good equipment. Just a very small percentage of them will cause a noticeable blurring of the tonal reproduction of any radio or phonograph. Hence this effect is very important for the proper operation of any good loud-speaker. An absolute minimum of variation of the current exciting the field of the speaker is obviously necessary. Since variation of current is inherently present in the choking operation, use of the speaker field as a choke is not warranted if quality of reproduction is of primary importance. Only well-filtered direct current should be used.

KEATS A. PULLEN, JR. (Enrolled Student)

(Graduate school of engineering, The Johns Hopkins University, Baltimore, Md.)

Progress in the Art of Metering Electric Energy

To the Editor:

As you were so kind as to acknowledge the Long-Schattner prepayment meter (*EE, Jan. '42, p. 63*), I take this opportunity of sending you a photograph of the Atkinson-Schattner maximum-demand indicator, together with the official Board of Trade notice concerning it. L. S. Atkinson was recently president of the Institution of Electrical Engineers of Great Britain, and was a colleague of mine.

E. SCHATTNER (M'18)

(Consulting electrical engineer, London, England)

EXTRACT FROM

The London Gazette

OF

FRIDAY, JULY 10, 1903.

Board of Trade, 7, Whitehall Gardens, London, July 9, 1903.

H. 9899.

For the purposes of the Electric Lighting Acts, 1882 and 1888, and of the Electric Lighting (Scotland) Act, 1890, and all Provisional Orders and Licences made and issued thereunder, the Board of Trade approve of the pattern and construction of the indicator (hereinafter described) for the measurement of electrical quantity when supplied on the constant potential continuous or alternating current system, namely:—

The Atkinson Schattner Maximum Demand Indicator deposited at the Board of Trade on the 3rd of June, 1903, by or on behalf of the Schattner Electricity Meter Company Limited, London, and sealed by the Board of Trade and known as the Atkinson Schattner Maximum Demand Indicator.

Provided that the indicator be tested, fixed, and used as described in the specification and instructions deposited at the Board of Trade and dated and numbered 19th June, 1903, and H. 9899.

The Board of Trade further approve of the means provided for fixing indicators of this description, and for connecting them with the service lines as described in the specification and instructions above referred to.

Signed by order of the Board of Trade this 9th day of July, 1903.

T. H. W. Pelham, Assistant Secretary, Board of Trade.

Figure 1 (left). Facsimile of notice by the London Board of Trade approving the use of the Atkinson-Schattner maximum-demand indicator

Field Testing of Generator Insulation

To the Editor:

The report of the EEI subject committee on "Field Testing of Generator Insulation" in the December 1941 section of AIEE *Transactions*, pages 1003–11, is outstanding in its excellent handling of a difficult subject and has given considerable impetus to the subject.

After close study of this report and related papers, it appears that an important truth may have been missed. If the initial and the two-year-old curves of Figure 3 on page 1005 are replotted as dielectric absorption curves upon Figure 1, page 1004, using the 60 degree centigrade temperature, it will be seen that the initial curve for 1938 is below that taken two years later in 1940 and is, therefore, the moister of these two curves. It is fairly well established that a difference in these slopes is an index of moisture, and it seems entirely rational to believe that moisture must have been driven off in the first two years of relatively high load, in addition to that remaining after the initial dryout run in 1938. While differences in volatile matter, aging, or curing may have some influence on the slope of the curves, it is easier to believe that change in moisture content has caused the major part of the change in these curves.

The slope of the dielectric absorption curve as an index of moisture has had startling confirmation in one 3,000-kva 2,300-volt generator winding measured by me, first, in clear dry weather with a dry Class A winding at 68 degrees centigrade after 27 hours at full load. The dielectric absorption curve rose steeply during five-minutes application at 1,000 volts to a final resistance of 150 megohms. The same winding was measured similarly after standing idle without heat for two days during cold, rainy weather, and with a final winding temperature of 16 degrees centigrade. This cold winding should have measured much higher than 150 megohms according to the well-known temperature effect, but the moisture effect completely obscured the temperature effect. Instead of a higher upward positive slope as expected, the readings began at 4 megohms and progressed downward in a negative slope and leveled off after about 12 minutes to 1.25 megohms. In no reports I have read has there been any mention of the possibility of this slope turning downward, and this seems to be new information. There was considerable apprehension felt as to the safety of returning this generator to full voltage service without dryout, although the generator had been off line only two days. However, the generator was brought up to full voltage successfully in four increments of voltage, the open-circuit core loss and windage furnishing some heat and ventilation. Our practice 20 years ago would probably have been to throw the generator on line with no thought of moisture content. We

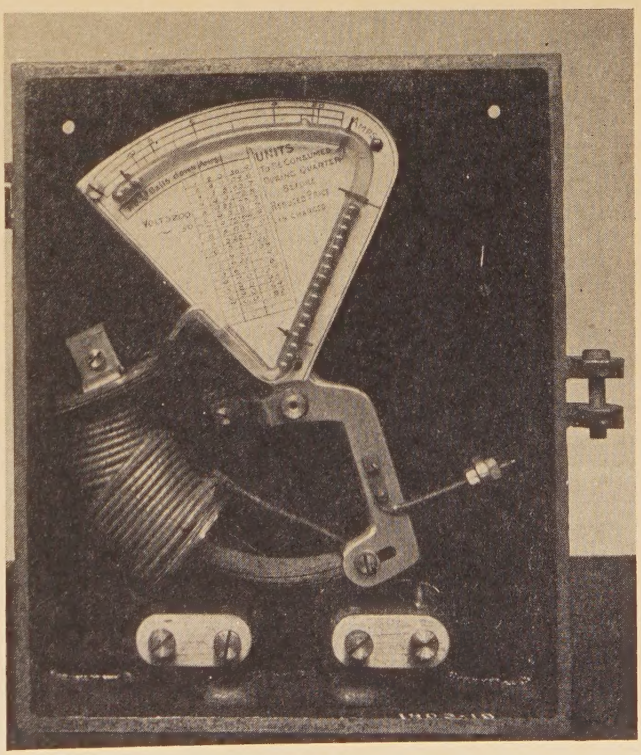


Figure 2. Atkinson-Schattner maximum-demand indicator, 1903 (Science Museum, South Kensington, London, England)

need more information of this type to show how much latitude it is safe to take in such a case.

If my belief is correct, that Figure 3 and Figure 1 both show moisture content, it follows that the constant "M" which expresses the slope in Figure 3 might very well be used as a standard numerical index and called "moisture slope M."

A study of Figure 3 will show that in comparing the 15-second readings of curves E and J whose slopes are $M = 1/38$ and $1/34$, the difference in slope is too small to be a decisive moisture index and curves A and F after 10 minutes would be much better. Also, if the megohm readings at 40 degrees centigrade of the upper group of curves representing a slightly moist insulation, are compared to the lower curves representing very dry insulation, the difference is small compared to the large spread if the 75-degree centigrade temperature is used instead. It would, therefore, be a happy solution to use the 10-minute points of the dielectric absorption curves for temperatures as near as feasible to 75 degrees centigrade and 40 degrees centigrade to obtain a "standardized moisture slope M," which may completely represent the moisture condition, if properly made, recorded, and used for comparison purposes. I propose to inaugurate this idea for standard comparisons between the various generators operated by the United States Bureau of Reclamation in the hope it will yield some valuable information.

H. H. PLUMB (M'29)

(Senior engineer, in charge of power-system operation and maintenance, United States Bureau of Reclamation, Denver Colo.)

NEW BOOKS • • •

Acoustic Design Charts. By Frank Massa. The Blakiston Company, Philadelphia, Pa., 1942. 228 pages, charts, etc., $4.

This book converts basic acoustic theory into a series of 107 practical charts of quantitative value which may be used without laborious computations and interpretations. The scales used have been chosen with a view to obtaining constant precision in reading the large range of values plotted. Families of curves on many of the charts reveal the quantitative effect of varying the parameters of a system. Sample problems have been worked out to illustrate the use of each chart. The subject matter includes the design of acoustic, mechanical, and electroacoustic apparatus, vibrating mechanical systems, isolation of machinery, noise reduction, electromagnetic and permanent magnet design, electric circuit, and other data.

The following new books are among those recently received at the Engineering Societies Library. Unless otherwise specified, books listed have been presented by the publishers. The Institute assumes no responsibility for statements made in the following summaries, information for which is taken from the prefaces of the books in question.

These and thousands of other technical books may be borrowed from the library by mail by AIEE members.

Diesel Engineering Handbook, Volume 2. Edited by L. H. Morrison. Diesel Publications, New York, 1941. 574 pages, illustrated, $9^1/_2$ by 6 inches, cloth, $5.

Intended to supplement previous editions. The material contained is either entirely new or an amplification of topics already considered. Engine efficiencies, specifications, special installations, and various types of auxiliary equipment not previously covered are discussed.

Marine Electrical Installation. By J. F. Piper. Cornell Maritime Press, New York, 1941. 308 pages, illustrations, etc., $7^1/_2$ by 5 inches, cloth, $2.50.

This manual is intended to aid the inexperienced workman to obtain practical insight into electrical marine work. The tools and materials used, the laying out of work, wiring methods, and power, lighting and communication systems are described in detail without undue use of technical language.

How Your Business Can Help Win the War. Compiled by the staff of industrial specialists of the Conover-Mast periodicals, edited by H. W. Barclay, with an introduction by D. M. Nelson. Simon and Schuster, New York, 1942. 111 pages, charts, etc., 11 by 8 inches, paper, $1.

Designed to show business men what the government wants to buy, how to bid, and how to get contracts and sub-contracts for government orders, it also indicates ways in which time and money can be saved and red tape cut in dealing with government offices.

Electrical Illumination. By J. O. Kraehenbuehl. John Wiley and Sons, New York, 1942. 441 pages, illustrations, etc., 9 by 6 inches, cloth, $3.75.

The principles underlying the specification and design of electric lighting for commercial and industrial buildings are presented as an elementary course for architectural and electrical engineering students. Maintenance and economic factors are discussed, and there are special chapters on floodlighting and novelty lighting. A bibliography accompanies each chapter.

University Physics, Part III, Light. By F. C. Champion. Interscience Publishers, New York, Blackie and Son Limited, London and Glasgow, 1941. 172 pages, diagrams, etc., 9 by 6 inches, cloth, $1.50.

One of a group of books on the several major divisions of physics, this volume aims to cover the subject of light for intermediate students who have previously studied the elements of physics. Exercises and problems are supplied for review purposes.

University Physics, Part IV, Wave-Motion and Sound. By F. C. Champion. Interscience Publishers, New York, Blackie and Son Limited, London and Glasgow, 1941. 67 pages, diagrams, etc., 9 by 6 inches, cloth, $1.65.

Attempts to cover the fundamental properties of wave motion, the propagation, characteristics and detection of sound, the vibration of solid bodies, and a brief discussion of acoustics. Exercises and problems are included.

Problems and Policies in Industrial Relations in a War Economy. Selected References, Fourth Supplement, January 2, 1942, Bibliographical Series No. 66. Princeton University, Industrial Relations Section, Princeton, New Jersey, 1942. 27 pages, 9 by 6 inches, paper, 25 cents.

Covering both American and foreign subject matter, the items listed in this supplement deal with problems and policies related to various phases of the labor question as they occur under war conditions, including employee training, hours, wages, housing, and legislation.

Horizons Unlimited, a Graphic History of Aviation. By S. P. Johnston. Duell, Sloan and Pearce, New York, 1941. 354 pages, illustrated, 10 by $6^1/_2$ inches, cloth, $3.75.

The story of man's conquest of the air is presented, and the social consequences of the development of the means of flight are considered. Brief discussions of meteorology and aerodynamics are also included.

Television, Today and Tomorrow. By L. de Forest. The Dial Press, New York, 1942. 361 pages, diagrams, etc., $9^1/_2$ by 6 inches, cloth, $3.75.

In this book the history of television is briefly recounted, how and why it works are demonstrated, and the functioning of a present-day studio is described. Television as a profession is discussed, as well as the probable future of television and its influence upon society.

General Trade Mathematics. By E. P. Van Leuven. McGraw-Hill Book Company, Whittlesey House, New York, 1942. 575 pages, illustrations, etc., $9^1/_2$ by 6 inches, cloth, $3.50.

The mathematics needed to solve actual shop problems in manufacturing and mechanical operations is presented for practical use. Beginning with arithmetical operations, the material includes simple algebra and geometry and specific industrial calculations. Practical problems are also furnished.

Fluorescent Lighting Manual. By C. L. Amick. McGraw-Hill Book Company, New York and London, 1942. 312 pages, illustrations, etc., $9^1/_2$ by 6 inches, cloth, $3.

Intended to provide information on the construction and performance of all types of fluorescent lamps. Principles and methods of calculating illuminating requirements and designing luminaires are given as well as methods and special pointers for installation and maintenance. A comparison of the economic factors of fluorescent and incandescent lighting is also included.